Compressed Air Magazine

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The TEST of TIME

148

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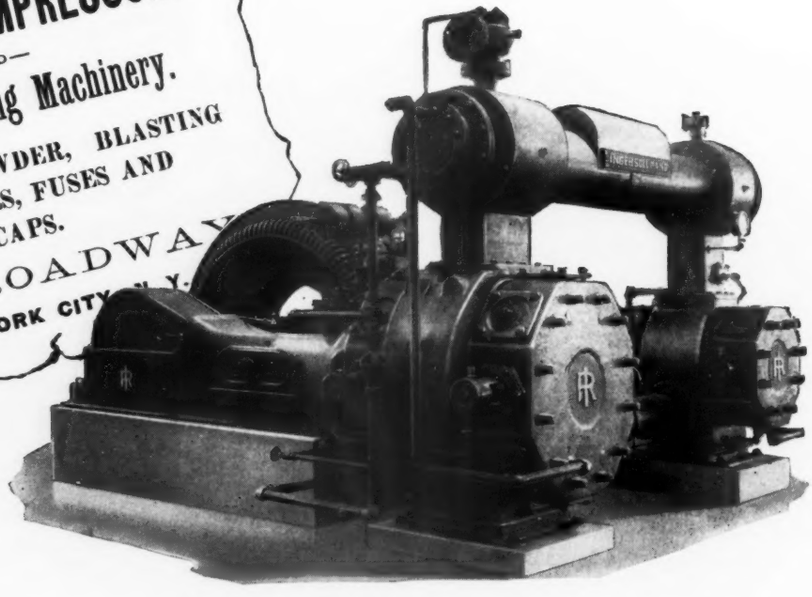

THE two above advertisements appeared in the 1881 edition of Poor's Railroad Manual. They feature a past generation of compressed air machines.

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Compressed Air Magazine

JANUARY, 1935

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AFTER ONE YEAR

The Melville Mine of the Rapidan Gold Corporation, which is the pioneer among the current gold seekers in this century-old field. The shaft headframe is shown in the center, with the power house at the left and the mill at the right. During a period of seven months this mill treated 2,000 tons of ore a month and paid all operating costs, including mine development. Within the past few weeks, ore has been discovered in the nearby Vaucluse approximately twice as rich as that of the Melville, indicating that a profit can be shown, particularly if a mill of larger capacity is provided.

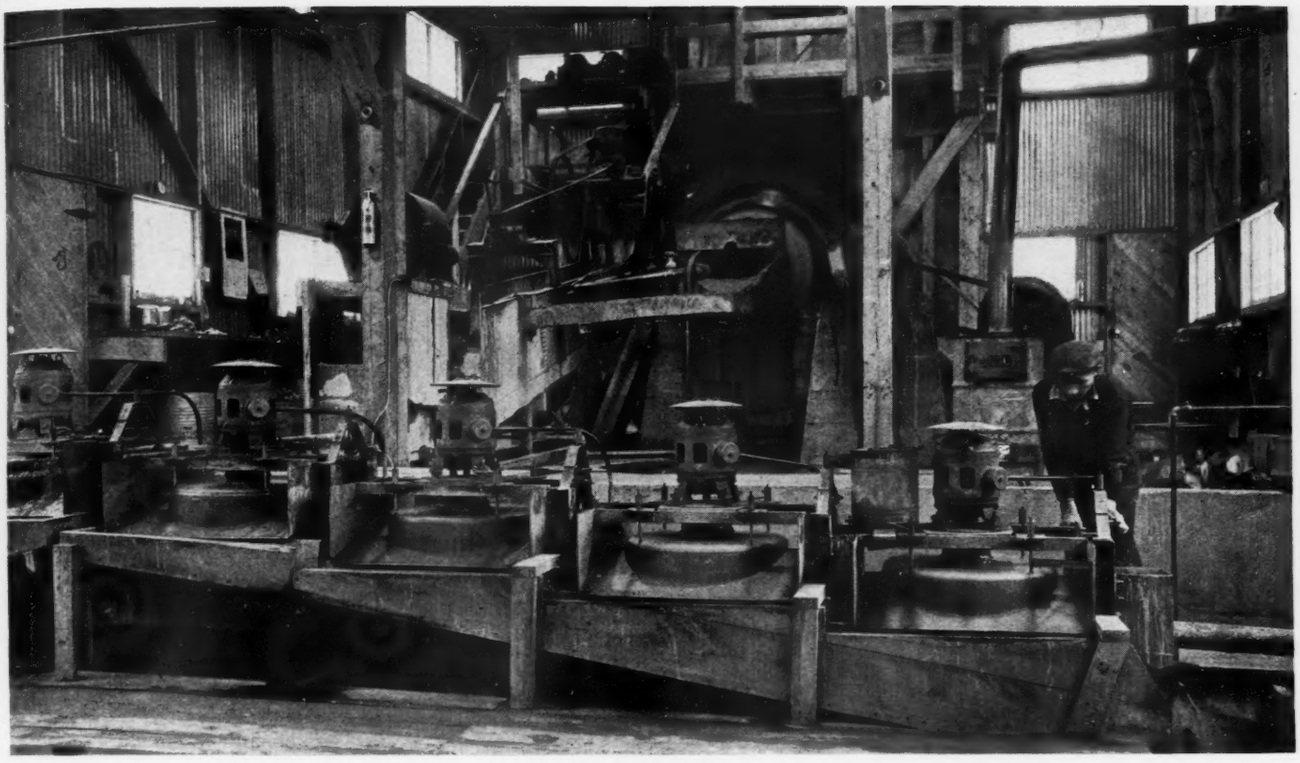
MODERN AIDS TO MINING

In contrast with the hand-drilling and cumbersome Cornish pumps on which the old operators in The Wilderness had to rely, present-day miners have efficient rock drills and other machines to lighten their labors and to speed their progress. To the right is a 12x11-inch Class ES-1 air compressor which supplies the drills at the Melville Mine. A compact, economical Motorpump (above) serves to dewater the Melville sump.

The Gold Hunt in Virginia Continues

C. H. VIVIAN

GOLDSEEKERS are still quietly but earnestly endeavoring to revivify some of the old mines in Virginia, and there are continuing indications that they will succeed. In a former issue we reviewed the history of this mining district, which was thriving long before the California gold discoveries electrified the country in 1849, and told of the efforts that were being made there to test the deposits which underlie the zone of former operations. During the year that has elapsed since that report was made, activities have broadened perceptibly: the number of prospects has increased from one to five, and the field of operations has been extended until it now includes five counties. Expenditures approaching $1,000,000 have been made for buildings, equipment, and payrolls; and approximately 250 men are now regularly employed.



THE MELVILLE MILL

This pilot plant has demonstrated that the sulphide ores of The Wilderness are remarkably amenable to flotation treatment. In the foreground are five Fagregen flotation cells. The concentrates, containing about 4 ounces of gold to the ton, are shipped to Carteret, N. J., for smelting.

This Virginia gold hunt is unique in many ways. There is no rush such as attends the search for precious metal in most parts of the world, and there will be none, regardless of the nature of the discoveries. This is so because all the land is patented, and no claims can be filed. Those who wish to seek gold there must first make satisfactory arrangements with the land owners.

Another distinctive feature of the search is that no one expects or hardly even hopes to uncover rich ore. The entire region was gone over as with a fine tooth comb by the miners who first swarmed into it more than a century ago. All the high-grade mineral that occurred in the zone near the surface where oxidizing agencies had a chance to exert their influence has, in all probability, been extracted. Evidences of these former activities abound. Extensive open pits remain to indicate the surficial explorations, and each has its surviving legend of the vast wealth that it yielded. Unfortunately, actual production cannot be even closely estimated.

Most of the early operators were English, and much of the gold they garnered was shipped directly to the mother country. United States mint figures are, accordingly, only partially informative. But, incomplete as they are, they show that the output was considerable. During several individual years in the early 1830's, Virginia, Georgia, and the states that lie between them, sent more than $1,000,000 in gold to the mint. Just how much went out of the country cannot be established; but, so far as Virginia is concerned, it seems certain that the total amount was appreciable. There is plenty of proof that the boats which regularly tied up at Falmouth, on the Rappahannock River just above Fredericksburg, were loaded with ore and concentrates for shipment abroad for refinement, probably in Wales.

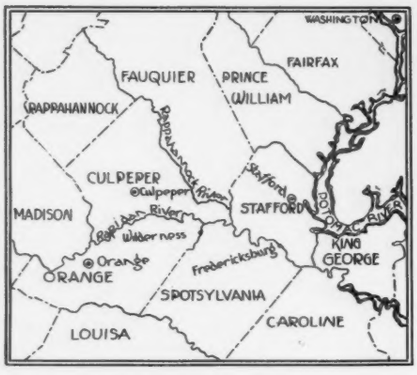
In addition to the open pits, there are long lines of depressions marking the course of underground workings which have since mostly caved in. Here and there along these lines are the ruins of old shafts. Their frequency proves that the early operators did not burrow far without providing additional openings to the surface through which to hoist their ore and to provide the ventilation vital to human endeavor. Enough of these old shafts and subterranean workings have been explored to establish the fact that virtually all the worthwhile deposits of oxidized ores which were amenable to treatment by the metallurgy then known were taken from the ground. Mining ceased abruptly because the entire region became a battlefield during the Civil War; but by that time all the workings were practically down to the sulphides. These ores constituted a puzzle to the operators; and this, together with the fact that rather strong flows of water handicapped their mining efforts, accounts for the nonrenewal of activities after the war terminated, save for a few sporadic attempts.

Present-day prospectors know that they must begin where the early miners quit, and they are aware that little or no rich ore remains. There are abundant indications, however, of large deposits of low-grade ores, and it is on these that they are relying. The conditions that have just been summarized call for prospecting methods different from those traditionally associated with virgin mining regions. The sourdough of popular fancy, with his pick, shovel, pan, and burro, has little place here. There is no ore to be struck at grass roots. All known veins of worth-while size have been mined to depths of from 40 to 100 feet. The only way to determine what lies farther down is to sink shafts and open drifts, and this procedure calls for well-organized and well-financed operations.

Another peculiarity of the Virginia gold hunt is the absence of local enthusiasm and excitement. Persons from outside the state are responsible for all the work being done, and, with minor exceptions, no local capital is involved. Fredericksburg, which is the administrative center of the operating companies, styles itself, not without ample reason, "the most historic city in America." It annually draws thousands of tourists who visit its numerous shrines and memorials that perpetuate the deeds of patriots. There is a vast civic pride in this historic past. The average resident can discourse at length on Washington, the Lees, Monroe, and other famous personages who spent momentous days there; but the possible

SCENE OF THE SEARCH

Present activities are centered in a belt running generally north and south in Fauquier, Culpeper, Orange, Spotsylvania, and Louisa counties. Three of the operations described in this article are located close to Wilderness post office. The nearness of this region to Washington is shown.



PROSPECTING SHAFT

For a number of months a group of Boston men has been systematically prospecting the old United States Mine tract on the Rappahannock River in an effort to locate the source of the rich float which is rather plentiful. They sank 120 feet at the site of an old shaft and drifted 300 feet, but the vein proved to be narrow and low in value. A second shaft will be sunk this winter.

imminence of a gold-mining boom produces scarcely more than a ripple of interest. Perhaps this is because Fredericksburg has heard talk before of reviving the gold mines.

Every few years for the past quarter-century or longer someone has come into the section with the announced intention of opening up the old mines, but in each instance their stay has been brief. The fact that nothing ever came of these previous attempts may well account for the complacent attitude of the populace now. By way of explanation of the failure of these various undertakings, it should be pointed out that they were small-scale operations which lacked the organization and capital necessary to adequately test the deeper parts of the vein system. The rural residents in the old gold belt are grateful for the coming of the new searching parties, because it means employment for them. They have had a hard time making a living from the soil during recent years, and steady jobs with regular incomes are proving a boon to them. Although mining technique is a strange thing to them, they are willing workers and develop rapidly under the instruction of trained men. Many of these laborers walk upwards of five miles to and from their jobs each day and attend to their farm duties after working hours and on Sundays.

Thus far, the Rapidan Gold Corporation is the only concern that has reached the production stage. Its operations are in the historic Wilderness section, about eighteen miles from Fredericksburg and close to the Rapidan River. The company holds a lease on 800 acres comprising the old Melville property, and owns outright the 200-acre Great Vaucluse tract. The latter was purchased from Henry Ford, who acquired it in order to secure for his Dearborn museum of early Americana the mine and mill equipment which its last operators abandoned there. The opening of the Melville by cleaning out an old shaft to a depth of 112 feet and drifting on the vein was described in our previous article. The massive, almost vertically dipping vein showed mineralization at intervals clear across its 40-foot width, with concentrations of ore at both its side walls. After several hundred feet of drifting had been done, a new shaft was raised to the surface at a point about 200 feet from the old one and sunk to a depth of 200 feet to establish a second level. This shaft was equipped with a skip and became the main working entrance to the mine. Meanwhile, a small mill was erected. Last May the property began producing, and for seven months approximately 2,000 tons of ore a month was milled.

Towards the end of the summer, activities were extended to the Great Vaucluse, which is several hundred yards from the Melville but on the same vein. When the company first entered the district it was believed that the Great Vaucluse offered greater possibilities than the Melville. But as operations at the Melville were well underway before the Great Vaucluse was purchased, it was elected to continue work there long enough to learn something of the property's value before spending additional money to open up the Great Vaucluse. The latter was originally worked in 1832, and by 1843 it had a plant valued at $70,000. In 1854 it was bought, together with the Grymes Mine, for £50,000 by the Liberty Mining Company of England. The average gold content of its ore was at that time reported to be worth $8 a ton. Prior to 1852 the workings consisted of two open pits which attained surface dimensions of 75x 120 feet and depths of 60 feet. Subsequently, six shafts were sunk, and in December, 1852, fifty tons of ore were being crushed and treated daily. The Rapidan Gold Corporation cleaned out one of the old 60-foot shafts, retimbered it, and sank it an additional 50 feet. A level was cut at this 110-foot depth, a crosscut driven to the vein, and about 150 feet of development work done. The vein showed a width of 22 feet, and 500 tons of $7 ore was extracted and trucked to the Melville mill for treatment.

Meanwhile, operations at the Melville were paying their way but yielding no profit. The ore there ran from $3 to $3.50 a ton, which was sufficient to cover the costs of mining, milling, and development but left no surplus for expansion. Approximately $3,000 a month was being expended in opening up the Great Vaucluse, and that went on for five months, until last December. C. Hyde Lewis, vice-president and general manager of the company, feels encouraged over the results obtained so far, but is convinced that operations can be put on a paying basis only by spending more money to develop the Vaucluse to a greater depth and by erecting a mill of larger capacity. Indications are that the Melville ore would yield a profit if a greater tonnage could be milled, while it is virtually certain that the Great Vaucluse can be made to pay if the present grade of ore continues in the vertical and lateral extensions of the vein which are yet to be tested. The continuation of the company's activities is,

THE GREAT VAUCLUSE

Operations of the Rapidan Mines Corporation at this site (left), where extensive surface mining was done before the Civil War, have proved the existence of $7 ore in what appear to be large quantities, and plans are being made to push development work. The surface equipment is driven by steam generated in a wood-fired boiler.

FRANKLIN SHAFT

This operation (below), sponsored by Paul G. Benedum, is proceeding in three shifts daily. A 5x9-foot shaft is being sunk, and drifting on the vein is being carried on concurrently. Surface openings over a stretch of 1,000 feet bear witness to the extensive work that was conducted in the section during the last century.

therefore, contingent upon the authorization of considerable additional expenditures, and work has been suspended pending a decision among the stockholders as to whether they wish to increase their investments by supplying the necessary funds.

The Melville is completely electrified, there being installed two oil-engine-driven generators which produce 360 hp. This current is used to drive a 12x11-inch Ingersoll-Rand Class ES-1 compressor; to operate a 52-hp. Lidgerwood hoist, a Motorpump for keeping the mine dewatered, and motors for crushing and milling the ore; and for furnishing lights in the plant buildings and residences.

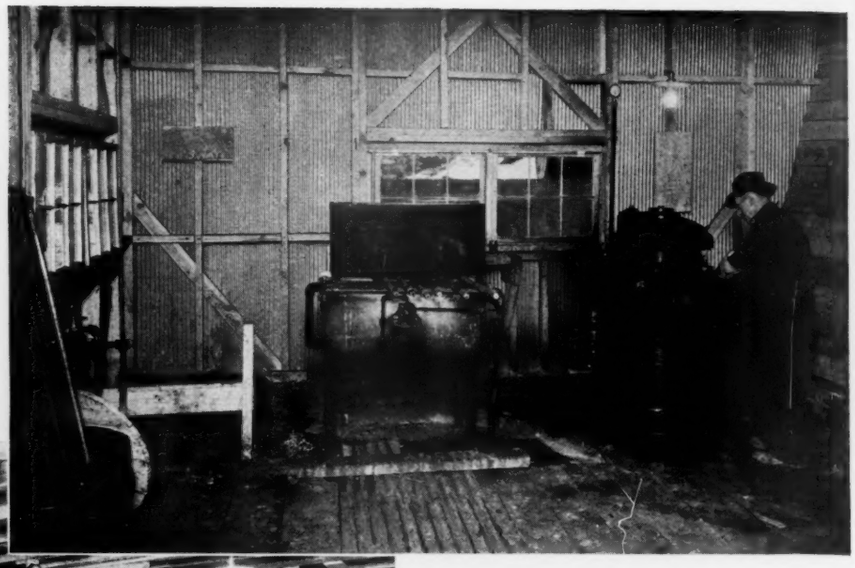
Two ore bodies of considerable size have been struck thus far in the Melville, both of them on the 200-foot level. The largest of these is on the hanging-wall side of the vein. It has been stoped by the square-set method to a height of 60 feet for a distance of 80 feet and has shown a width ranging from 25 feet at the bottom to 12 feet at the top. About 5,000 tons of ore was taken from this opening during the months of October and November just past. The second sizable ore body was encountered on the footwall. Some faulting has been found, but to date it has in no case been serious enough to displace the vein more than a few feet.

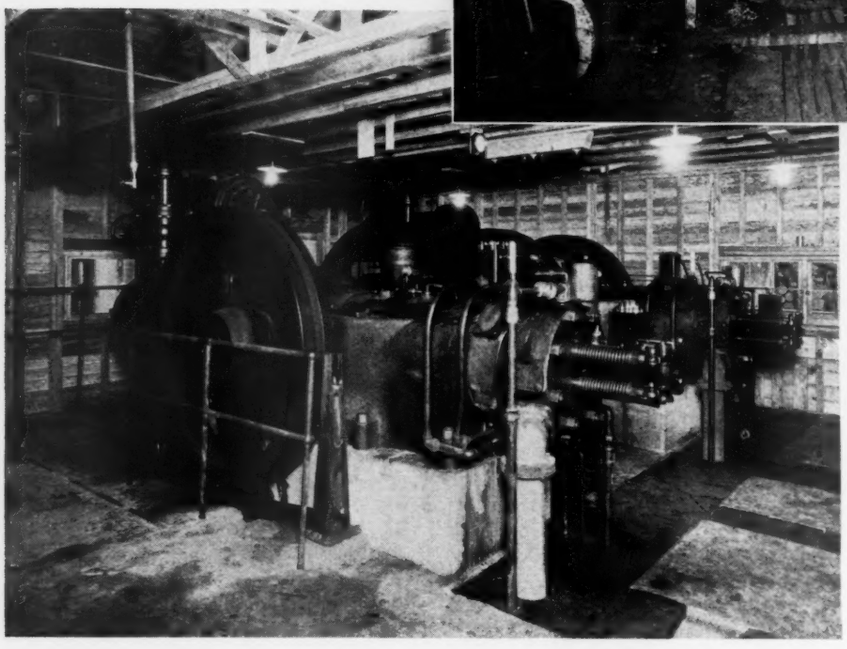
Drilling equipment consists of three S-68 "Jackhamers," one R-39 "Jackhamer," and one CA-31-W1 stoper. The "Jackhamers" are mounted for drifting. These drills also have been used for all the shaft-sinking and development done at the Great Vaucluse, the work having been scheduled so that they could be employed alternately at the two properties.

The ore which is hoisted goes to a 1-inch grizzly on a 30-inch sorting belt 20 feet long. The material which will not pass through the grizzly is fed to a 20x12-inch jaw crusher that reduces it to a 1-inch maximum size. All ore is then elevated to a

THE LAIRD PROSPECT

The Melba Mining Corporation, backed by Pittsburgh capital, is sinking a 3-compartment shaft which may be carried to 450 feet before prospecting is started. The site is in the heart of The Wilderness battlefield of Civil War days.





EQUIPMENT AT THE FRANKLIN
The two oil-engine-driven compressors below supply air for drilling and for other purposes. Drill steels are reconditioned in the modern blacksmith shop shown at the right. On the opposite page is pictured the assay office which has been set up to keep a close check on the value of the ore developed.

fine-ore bin at the mill, where it is reduced in a Hardinge 6x22 ball mill until 70 per cent of it will pass a 200-mesh screen. The ore has proved admirably adapted to flotation treatment, and is handled in five Fagregen cells which use as reagents pine oil and xanthate which are introduced by a Denver reagent feeder. A Dorr classifier is installed. A very satisfactory recovery is made, the tails showing an average value of only eighteen cents. A 4-ounce concentrate is made and is shipped to Carteret, N. J., for smelting. The mill has been handling an average of 75 tons a day and at times has treated 90 tons, which is the limit of its capacity.

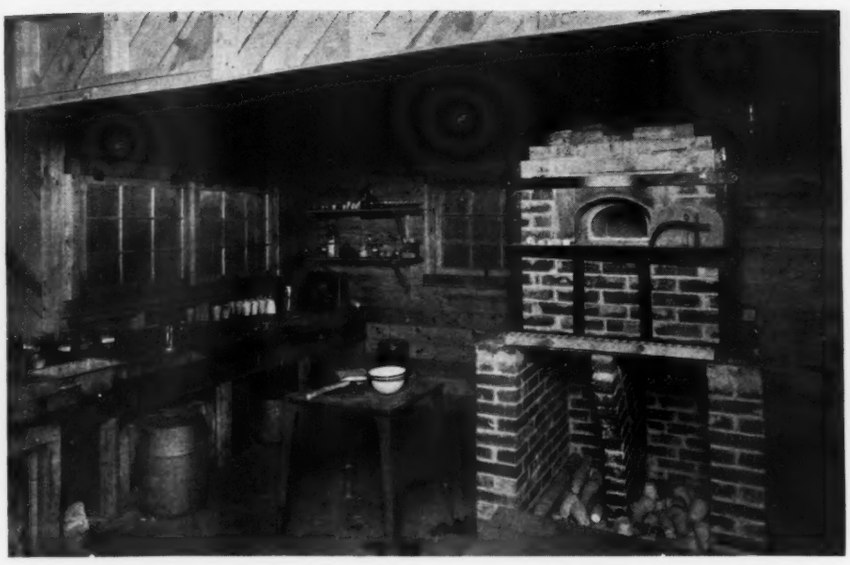
For the preliminary development of the Great Vaucluse, a steam plant was erected. As wood is plentiful on the property it has been used for fuel. An NF-1 compressor and a small steam hoist are provided. An Ingersoll-Rand 2-stage, air-cooled portable compressor, which was used at the Melville prior to the installation of electric generating equipment, is also available for service when additional air is required.

Prospecting operations of considerable magnitude are being conducted at two points in the Fredericksburg area by interests associated with the Benedum Trees Oil Company of Pittsburgh, Pa., a concern which has been successful in the petroleum industry for a number of years. Officials of the company concluded some time ago that gold mining had promising potentialities and decided to venture into it. Consultants employed by them reported favorably upon the Virginia possibilities, so they acquired control of 4,000 acres of land in Orange, Culpeper, and Faquier counties and immediately began a $500,000 development program at two points. One of these enterprises is being conducted in the name of the Melba Mining Corporation, while the other is the personal venture of Paul G. Benedum, who is directing both undertakings.

The aim in both cases is to determine the extent and the value of the deeper-lying sulphides as quickly as practicable, and with that end in view shafts are being sunk at two separate locations. These shafts will be carried to a depth of at least 300 feet and possibly 450 feet. According to Mr. Benedum, development work will be pushed with the hope of making available a large tonnage of low-grade ore; and if these efforts are successful, one or more mills will be erected.

Mr. Benedum's personal project is the old Franklin Mine, about three miles from Morrisville, in Faquier County. According to an article in *Engineering and Mining Journal* of November 10, 1877, which was written by J. H. Morton, a mining engineer, the Franklin Mine had then been worked periodically for 40 years and had produced 100,000 tons of ore averaging $12 a ton in value. When he wrote, the Franklin was abandoned, and the workings, some 860 feet in lateral extent, were flooded with water. At one time a 20-stamp mill was in operation; and in 1901-2, one thousand tons of tailings from this plant were cyanided, with reported unprofitable results. The mine was last worked in 1904 or 1905.

There are two parallel veins, the Franklin and the House, about 163 feet apart. Both dip at an angle of about 80° from the horizontal. An old shaft, which was 85 feet deep, was retimbered and given a concrete collar. This shaft is 5x9 feet in cross section and is being extended downward. It enters the sloping vein at 111 feet and passes out of it again at 160 feet. A station has been cut at 150 feet and drifting started on the vein, which is 12 feet wide at that point. Meanwhile, the shaft is being deepened, and on January 15 it had reached a depth of 304 feet. Crosscuts will be driven from this shaft to the House Vein, and eventually eight working faces will be provided on the two veins. Explorations and old reports indicate that old levels existed at depths of 50 and 85 feet, and that the Franklin Vein was stoped to a height of 15 feet for a distance of about 450 feet. These old workings are badly caved now, and the course of the Franklin



Vein is easily traced by the trench-like depression on the surface. The Franklin Shaft is in rock of diorite classification, whereas most of the Virginia gold veins are in schist.

One of the accompanying illustrations conveys an idea of the character and extent of the plant that has been constructed at the Franklin property. It is completely equipped with modern machinery. A 57-foot oak headframe stands over the shaft, which is served by an American single-drum hoist driven by a Waukesha gasoline engine. Compressed air is supplied by two 600-cfm. Ingersoll-Rand Type POC-2 oil-engine-driven compressors Six I-R drills are used. Two diesel-engine generators furnish electricity for lighting and incidental purposes. The blacksmith shop conditions steel for both of the company's operations. It contains a Type 40 sharpener, a 27-F oil furnace, and a 4-K shank grinder.

The Melba Mining Corporation's prospect is in Orange County, approximately a mile from the Melville and Great Vaucluse properties but apparently on a different vein system. Reports prepared for the company indicate that there are nine veins in the area varying in width from 6 to 13 feet. Among the old shafts on the tract were the 93-foot Laird and the 156-foot Barney. A site near the former was selected for initial activities and work was begun on the sinking of a new shaft, which also takes the name Laird. This is a 3-compartment shaft, measuring 5x15 feet inside the timbers. Solid rock was not struck until a depth of 115 feet was reached, and the section of the shaft above that level was concreted. Sinking operations were done for a time with a small air-operated hoist, but when the property was visited, in December, a 57-foot oak headframe was being assembled and a 42-inch Lidgerwood single-drum hoist was on the ground, together with a 75-hp. Waukesha diesel engine for driving it. The plan is to continue sinking operations through the center compartment with the small equipment while the larger headframe is being installed. It is intended to carry this shaft to a depth of 300 feet before starting development work.

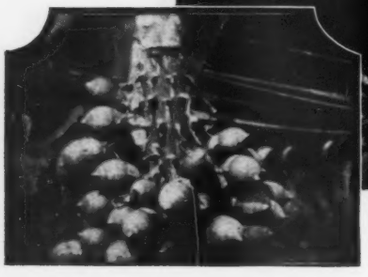
An Ingersoll-Rand Type POC-2 compressor of 600-cfm. piston displacement, similar to the units at the Franklin, provides compressed air for the Laird operations. Electric power is supplied by a 35-kw., diesel-engine generator. A number of substantial buildings has been constructed to accommodate the staff and workmen. Both the Laird and Franklin operations are being conducted on a 3-shift basis, and approximately 65 men are employed at each property. Lee Kellum is general superintendent for the Melba Mining Corporation, with G. E. Wearing in charge at the Laird and J. L. Darnell, Jr., at the Franklin.

Since last May, systematic prospecting has been carried on in Spotsylvania County near the junction of the Rapidan and Rappahannock rivers by North American Mines, Inc., of Boston. This company, whose officers are all associated with the Calumet & Hecla Copper Company, owns 1,100 acres known as the United States Mine tract, which has an interesting history. An indenture dated February 17, 1797, which is now in possession of Judge Alvin T. Embrey of Fredericksburg, records the transfer of the land from Gov. Alexander Spotswood to Henry "Light Horse Harry" Lee of Revolutionary War fame. This document is about 18 inches wide and nearly 3 feet long, and is completely covered with script. Its top is notched or indented where it was separated from its companion piece. It was this custom of cutting the copy from the original along a jagged line that gave rise to the term "indenture," the authenticity of a deed to property being established if the notched edges of the two fitted together perfectly along the line on which they had been severed. For some undetermined reason, Lee conveyed the property to the United States Government in 1812. In the opinion of Judge Embrey, this was the first parcel of land in the colonies thus to pass from private to government ownership.

Judge Embrey was responsible for the North American Company becoming interested in Virginia gold mining. He wrote Prof. W. Spencer Hutchinson, dean of the School of Mines of Massachusetts Institute of Technology, suggesting that students who wanted practical experience which would net them a living during their vacations might find it panning the streams near Fredericksburg for gold. Dean Hutchinson mentioned this matter one day to some of the Calumet & Hecla officials, and the outcome of the conversation was the formation of the company. Since last May investigations have been conducted under the direction of Dean Hutchinson, with his son, W. S. Hutchinson, Jr., a graduate of M. I. T., in active charge of a party made up of about ten men.

Old reports state that the United States Mine, situated near the Rapidan River, was producing $600 in gold a week in 1836, and that a reduction plant, consisting of stamps and Chilean mills, was in operation. The vein was said to be 2 feet wide. The first step of the present gold hunters was to recondition and deepen the old shaft. By means of a portable compressor, one "Jackhamer," a Cameron sinking pump, and a "Little Tugger" hoist, a 2-compartment opening was carried to a depth of 120 feet, where the vein was located and drifting started. After following the vein for 300 feet and spending four months in the effort, work at that point was terminated because the ore proved too low in value to warrant mining.

Investigations of various surface areas had in the meantime disclosed that gold could be obtained by panning the earth at almost any point. Here and there, where there were evidences of old workings, pieces were found which assayed relatively high, and some float was picked up that ran as much as $400 to the ton. With these abundant indications of a sizable ore body somewhere in the vicinity, an intensive examination of the ground was undertaken, beginning at the mine shaft and gradually working back to the river. Wherever there was proof of mineralization, trenches were dug across the prevailing vein direction, some of these excavations being carried to considerable depths and lengths. In numerous cases, small veins were revealed and some rich ore was secured, but it occurred only as stringers which showed little continuity. These explorations are still proceeding, and it is planned to sink another shaft at a likely location.



Babassu: a Nut That May Enrich a Country

BABASSU PALM AND FRUIT

A fine specimen (top) of the tree that promises much for the industrial future of Brazil. Clusters of nuts may be seen on either side of the trunk. This view shows the typical swampy ground in which the babassu flourishes. At the bottom is pictured a spendid example of the fruit—a cluster containing some 300 nuts.

EDWARD J. TOURNIER

SHOULD the time come in Brazil when sufficient capital will be available to meet the needs of industrial expansion, that country can make use of a natural resource which may go far towards placing our South American neighbor among the world's industrial leaders. A single tree, growing in abundance in her native forests, bears a nut which, it is estimated, has nearly fivefold the value of Brazil's famed coffee crop. This nut holds within it the essentials for producing, or helping to produce, edible and soap oils, engine fuel, building material, alcohol, acid, brushes, brooms, mats, and iron.

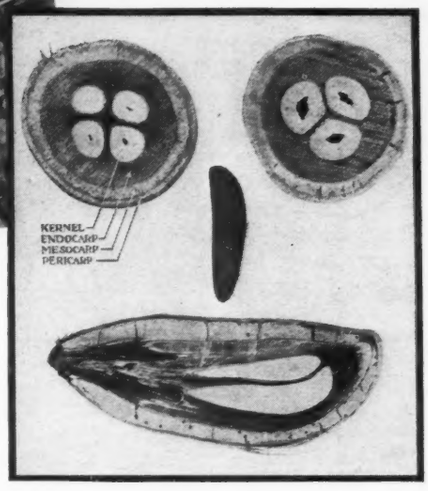
Fully exploited, the known supplies of this raw material represent a potential value of nearly 12,000,000,000 milreis annually. At the present rate of exchange this amounts to about $1,000,000,000. This remarkably fruitful resource is the nut of a palm tree—the babassu, as it is called in Brazil. Its scientific classification is of comparatively recent date. The *Dictionary of Useful Plants of Brazil* describes it as a tree which, at maturity, reaches a height of 60 to 70 feet and a diameter of 24 to 30 inches. At the top is a crown of fifteen to twenty flat leaves approximately 25 feet long. After flowering, the palm bears bunches of nuts, each nut inclosing three or four kernels. The trees start yielding when between ten and fifteen years of age, and sometimes at eight years. Each produces an average of four bunches, containing a total of approximately 1,200 nuts. These weigh about 270 pounds, of which 27 pounds represents kernels and 243 pounds husks.

The babassu flourishes in vast regions stretching from Amazonas to Bahia and including the states of Goyaz, Matto Grosso, Piauhy, Maranhao, and Para. In Piauhy, where an American technical committee studied its possibilities, there are, roughly figured, 400,000,000 trees. Other states apparently have equally extensive groves, which indicates that Brazil possesses at least 1,000,000,000 palms of this species. A conservative estimate of their annual yield is 13,200,000 tons of kernels and 119,000,000 tons of husks.

Of the palm itself nothing is wasted. The trunk supplies building posts; and the bunch stalks, after rotting, furnish an excellent fertilizer. The leaves are used in the making of hats, mats, and fish traps. When woven, they also serve as partitions and as thatched roofs for workmen's dwellings. A long *palmito*—sprout, which is derived from the babassu, is edible and much appreciated by the natives because of its delicate flavor.

The great value of the tree principally lies in its fruit, for the endocarp, or stone, and the kernels yield products which, if applied industrially, may some day form the basis of a great national prosperity. The kernel is rich in oil, and this is the prime reason for its exploitation. An analysis of the kernel by the Brazilian National Museum indicates the following percentages of constituents: water, 13.21; oil, 66.75; protein, 2.60; cellulose, 2.51; sugar and other carbohydrates, 13.26; ozoted substances, nonprotein, 0.88; and ash, 0.79. Its inherent high food value is apparent when it is known that babassu-nut butter contains 99.97 per cent pure fat as compared with 84.90 per cent for cow's milk butter and 98.33 per cent for lard. The mineral content is only 0.01 per cent. It is used in Brazil as a substitute for olive oil and butter fat.

Babassu oil is extensively employed in the country of its origin as a lubricant and in the manufacture of perfumery and soap.



PRIMITIVE WORKING METHODS

Natives break the husks with clubs or axes to extract the kernels. Machine methods are applied to large-scale operations. Below are transverse and longitudinal sections through a babassu husk, with the names of the various parts marked. In the center is an individual kernel.

For the latter purpose it is considered superior to whale oil, which is much in demand in the United States. According to Brazilian government experts, it is more suitable than crude petroleum as a fuel for diesel and semi-diesel engines. The cake which remains after the oil has been pressed from the kernels is still highly nutritive and serves widely as cattle feed.

The husk of the nut not only provides valuable by-products but also may be the means of making Brazil independent of coal for iron smelting. The importance of this will be evident when it is recalled that that country possesses nearly half of the world's iron ore but has no known coal deposits. Therefore, the development of an iron industry has been retarded and will be until a plentiful substitute for coal is found. Such a substitute is seemingly at hand, for the babassu husk has all the properties of the best metallurgical coke.

In their natural state, as they come from the nuts, the husks are an excellent fuel which is burned on river steamers and railroads. However, such a use results in the waste of valuable by-products. When subjected to distillation, they yield a charcoal that compares well with ordinary steam coal. The husks have several valuable constituents. These are, in percentages: gas, 18; methyl alcohol, 1.3; crystalline acetic acid, 4.2; tar, 5.4; and the charcoal, 29. The latter is made up as follows, the figures also being given in percentages: moisture, 7.7; volatile matter, 3.7; ash, 4.7; fixed carbon, 83.9.

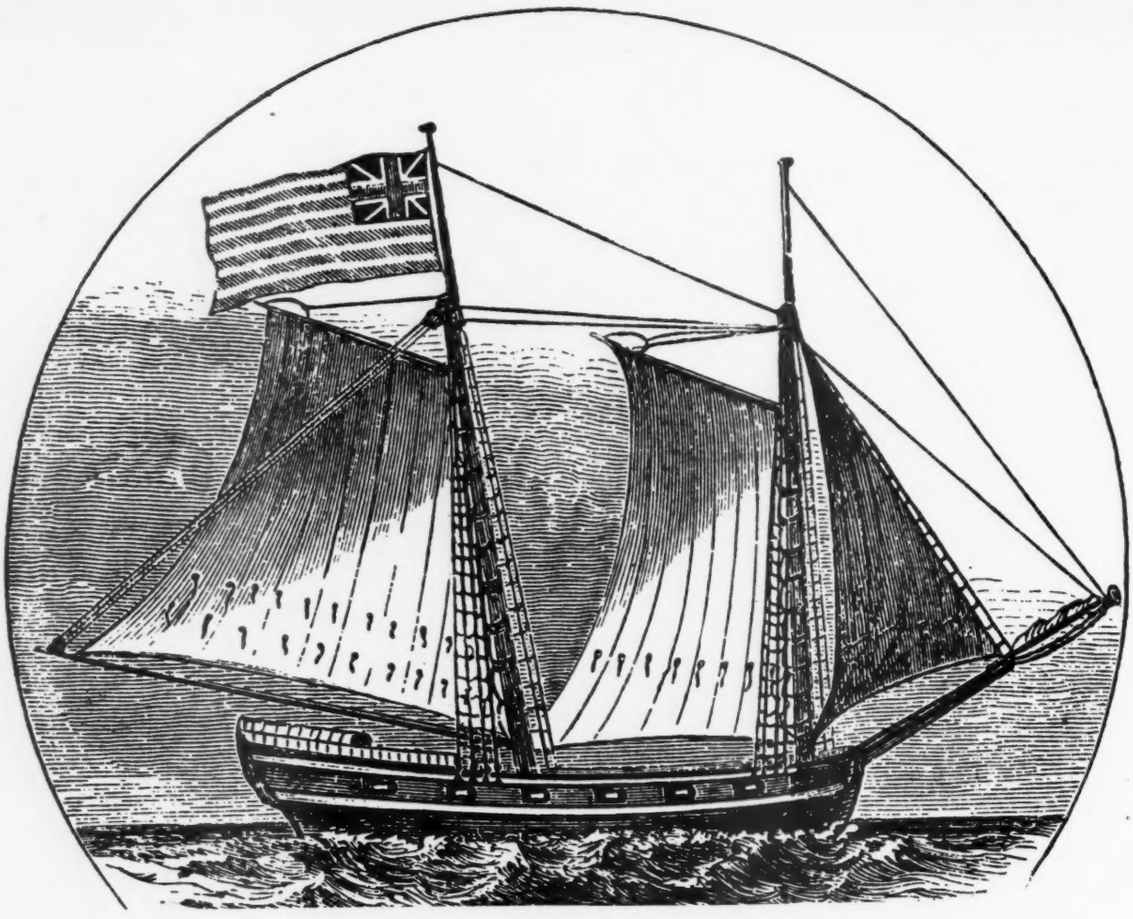
Briquettes would seem to be the best form in which to offer babassu charcoal for general use. Tests have revealed that such briquettes are at least the equal of metallurgical coke in the smelting of iron ores. Fortunately, the tar derived through carbonization of the husks provides an excellent binder The manufacturing process is the same as that commonly employed in making briquettes from other fuels, and consists of drying the charcoal, pulverizing it, preheating it to a suitable temperature, mixing it with the binder in correct proportions, and then compressing the mass into bricks.

Since the World War, the economic trend in every country of importance has been towards industrialization in an attempt to equalize trade balances. Everywhere the success of such efforts has been more or less dependent upon the possession of coal and iron. Although she has abundant iron-ore resources, as already mentioned, Brazil has been importing iron and steel products at the rate of nearly 600,000 tons annually, as well as 2,000,000 tons of fuel made up of 400,000 tons of oil and 1,600,000 tons of coal and coke. Inasmuch as Brazil manufactures only 30,000 tons of iron a year, the difference between her output and her imports represents a large adverse trade balance. The use of babassu-charcoal briquettes as blast-furnace fuel would make it possible for her to produce all the iron she needed and, besides, leave 100,000,000 tons a year for export. Moreover, it is estimated that the oil extracted from the nuts required to furnish husks for this fuel would be sufficient to offset the present imports of fuel and provide an excess valued at more than $60,000,000 annually. In short, the industrialization of the babassu nut would enable Brazil to compete in the markets of the world with her coal, oil, and iron. Based on her known iron-ore reserves, she would have an exportable surplus of 100,000,000 tons of iron a year for approximately 160 years.

A little speculative figuring on the possibilities of the babassu tree might prove entertaining. For example, cost studies have indicated that by sintering the existing millions of tons of powdery iron ores, thus making them available for blast-furnace reduction, pig iron could be laid down in New York for $10 a ton. Sinter, as many of us are aware, can be produced for about one-third of the market value of raw ore.

In order to visualize the magnitude of the opportunity which the exploitation of the babassu offers, it is not necessary to consider more than one state, that of Piauhy, which, unlike some of the others, has been thoroughly surveyed. In this part of Brazil, as previously stated, are around 400,000,000 trees which, with an annual yield each of 63 pounds of charcoal, 3 pounds of methyl alcohol, 10 pounds of acetic acid, and 12 pounds of tar, have a potential total value of $1,017,723,792. These figures are from a 1929 report, but in converting the Brazilian money into United States currency the present rate of exchange of 8.5 cent per milreis (par value, 20.255 cents) has been used. The nuts or raw material can be purchased in Brazil for $5 a ton.

In addition to the aforementioned products, the nuts would supply yearly some 3,300,000 tons of babassu oil which could be produced at a cost of less than $25 a ton. The point of interest in connection with this is that Brazil could meet her own needs of 400,000 tons and have left for export more than 2,500,000 tons. This is more than three times the amount of oil of all kinds imported into the United States in 1929.



Lake Champlain Yields Wreck of "Royal Savage"

R. G. SKERRETT

A MARINE salvor, with a historical urge, has recently done a fine bit of work in the recovery of all that now survives of the schooner *Royal Savage*, which was sent to the bottom of Lake Champlain nearly 160 years ago when gallantly resisting a formidable British naval force under the command of Gen. Sir Guy Carleton. In the course of the last half century, well-nigh a score of divers at different times have sought to locate that wreck and to effect its salvage, but without success until the summer of the year gone.

Probably, to most of us, the *Royal Savage* is either unknown or forgotten among the more commonly emphasized phases of the Revolutionary War. Nevertheless, in 1776, that armed schooner was the flagship of a squadron, under Gen. Benedict Arnold, that was feverishly called into being to hamper, if not to halt, the force assembled by General Carleton for the purpose of invading the country via Lake Champlain and the Hudson River. The *Royal Savage*, though sacrificed in the battle that was fought a few miles south of Plattsburg in October of that year, did play her utmost part in checking the advance of General Carleton who, having looked upon "the countenance of the enemy," as he quaintly expressed it, decided not to push his campaign southward into a region bristling with untold difficulties during the winter. Instead, he retired for the cold months to a base at St. Johns, on the Richelieu River. The breathing spell thus afforded the Continental Army gave General Washington time to concentrate his troops in the vicinity of Saratoga so as to bring about the battle that compelled General Burgoyne to surrender on October 17, 1777, thus effectually ending the threat of an invasion from Canada that was designed to split the country in twain. Benedict Arnold also did valiant service in the second and concluding Battle of Saratoga in which was brought to a climax the resistance that had its beginning at the Battle of Lake Champlain.

Remains of Long-Sought Historic Hulk Salvaged a Few Months Ago

It is a matter of record that Arnold, late in 1775, led a military force up the Kennebec River for the purpose of attacking the British stronghold of Quebec. According to plan, his men were to combine with Gen. Richard Montgomery's troops which were simultaneously approaching that city from the west. In the assault on Quebec on that frigid December 31, 1775, Montgomery was killed, Arnold was severely wounded, and the American troops were repulsed. En route, Montgomery had captured Mont-

BEACHED AT LAST

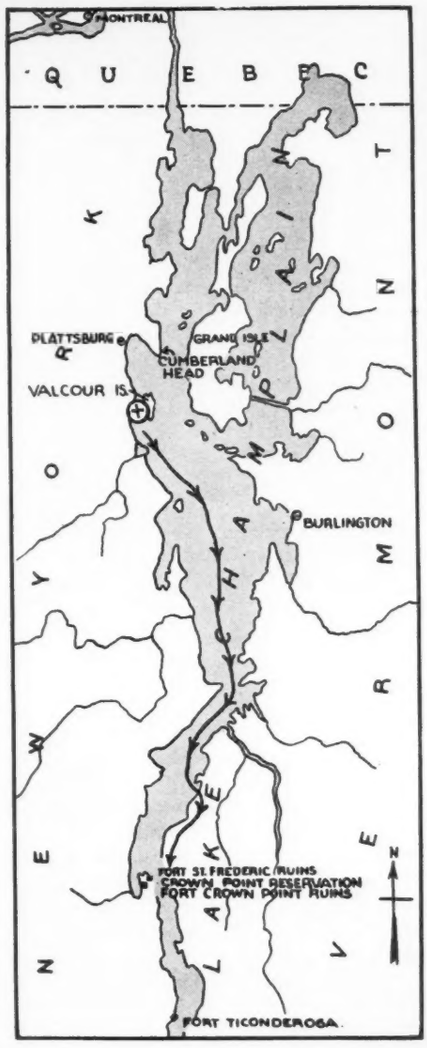
The skeletal remains of the once proud fighting ship, gaunt and forlorn, are drawn up on the edge of the lake (left). To prevent relic hunters from carrying it off piecemeal, the hulk was dismantled and shipped to a safe storage place for subsequent reassembly.

In the location map, in the center, the cross between Valcour Island and the mainland marks the spot where the *Royal Savage* sank. The line of arrows indicates the course taken by General Arnold's fleet to the scene of the second battle, after which the survivors landed and made their way to Fort Crown Point.

real and St. Johns, near the outlet of Lake Champlain. Under the terms of capitulation, the British commander at St. Johns turned over to the victorious Americans, among other military property, the schooner *Royal Savage*. When Arnold led the remnants of the shattered American forces back to this country, he did so via the Richelieu River and Lake Champlain—incidentally sailing southward from St. Johns with the *Royal Savage*. That craft became the nucleus of the squadron that he constructed at Skenesboro, at the southern end of Lake Champlain, in anticipation of the retaliatory British thrust that was a foregone conclusion.

At that period Lake Champlain was bordered on both flanks by a densely wooded wilderness: there were no roads over which supplies for an army could be moved. At best the neighboring forests offered trails only for such Indians and white men as were familiar with the region, and the lake, therefore, presented the logical path for an invading army. With Crown Point and Ticonderoga in the hands of his enemy, General Carleton took steps to provide himself with an armed fleet of such strength as would make it possible for him to batter his way southward to Lake George and thence to the headwaters of the Hudson River—with Albany his ultimate objective. To assure himself unsuspected strength, he had built in England, and then knocked down for transport to St. Johns for reassembling, three ships of a size never before seen on Lake Champlain. There, with the aid of skilled shipwrights, he created a squadron totaling 25 vessels carrying all told 89 guns. When ready, he had at his disposal 1,000 men—among them 670 seamen and eight naval officers and petty officers.

Meanwhile, Arnold worked ceaselessly at Skenesboro, although he was much hampered by the inexperience of his men. Even so, he constructed a flotilla of fifteen vessels that carried a total of 88 guns and an organization of 700 men but few of whom were seamen—most of them being quite unprepared, save in their abundant



courage, for the test that lay ahead of them. Despite his handicaps he was ready for Carleton when the British fleet appeared at sunrise on October 11, 1776, off Cumberland Head. Anchored several miles south of that point, at the northern end of the passage between Valcour Island and the west shore of the lake, was Arnold's squadron, which was made up of the following units: the 12-gun schooner *Royal Savage*, the 12-gun sloop *Enterprise*, the 8-gun schooner *Revenge*, the 8-gun galley *Trumbull*, the 8-gun galley *Congress*, the 8-gun galley *Washington*, the 6-gun galley *Lee*, the 5-gun gondola *Spitfire*, the 5-gun gondola *Connecticut*, the 3-gun gondola *New Haven*, the 3-gun gondola *Providence*, the 3-gun gondola *Philadelphia*, the 3-gun gondola *Jersey*, the 3-gun gondola *New York*, and the 3-gun gondola *Boston*. The heaviest of the British weapons were 24-pounders, while the most formidable of Arnold's pieces were 18-pounders.

General Carleton, sailing to the eastward of Valcour Island, did not discover his opponent's flotilla because of intervening timber until the British fleet had cleared the southern end of that island where only the smaller and handier of his vessels could swing around and go into action. Therefore, the head of the British line was not able until somewhat later to come about and to beat up against the wind toward the American force. Arnold in the meantime, taking advantage of the favoring wind, advanced boldly to meet his foe with the *Royal Savage*, the *Congress*, and two other lesser craft. Before engaging

CRUMBLING WALLS

All that is left of the barracks at Fort Crown Point, where General Arnold's band rested before continuing to Fort Ticonderoga.

the enemy, he had shifted his flag to the double-ender *Congress*, which could be maneuvered readily forward or back with oars and thus made it possible for him to direct the fight from any part of his line.

The battle started with a broadside from the British schooner *Carleton*, the Americans responding with vigor. When the bulk of the British squadron was able to move into line of attack, Arnold was compelled to retire toward the remainder of his flotilla for support. It was during that maneuver that the *Royal Savage* was disabled by the enemy's guns; and, while undergoing emergency repairs, she ran aground off the southwest point of Valcour Island and promptly became an immovable target for the entire British force. Being obliged to abandon her, the Americans jettisoned what they could of her armament before escaping into the forested depths of that island where most of them fell victim to General Carleton's Indian allies who had followed them. The British then boarded the *Royal Savage* and held her until nightfall when, apprehensive of an American counterattack, they set fire to her and sent her to the bottom, her magazine blowing up.

For five hours the conflict raged. Arnold's flagship was hulled twelve times by British round shot, and seven projectiles pierced her at the water line; but her personnel, composed mostly of farmers, plugged the holes and fought on undismayed. General Waterbury, on the *Washington*, assumed command of the *Congress* after her captain, lieutenant, and master had died at their posts. The vessel was little better than a sieve when the action came to a close at dusk. The *Philadelphia* foundered within an hour after the fight ended. The outcome was a drawn battle that cost the Americans 60 lives and three ships, while the British loss was 40 men and three gunboats.

Under cover of the succeeding dark and stormy night Arnold ran his surviving craft through the enemy's line which lay across the southern entrance to the channel between Valcour Island and the mainland to the west— a shaded light at the stern of each American vessel guiding the one immediately behind. Arnold, in the *Congress*, brought up the rear to guard his squadron from attack. The Americans were ten miles away to the south when daylight revealed to General Carleton that he had been outwitted. When at a safe distance, Arnold anchored and made what repairs he could to his battered flotilla; but two of his gondolas were so badly damaged that they were sunk.

The British took up the pursuit, and on October 13 a second battle was fought— the Americans standing indomitably to their guns until Arnold ordered his small galleys to be beached on the east shore of the lake about ten miles north of Crown Point. Arnold covered that retreat on board the *Congress* until those boats had been run ashore and fired. Then he also beached the crippled *Congress* and stood by until she was a mass of flames. With that done he assembled his survivors and marched them over a trail to Crown Point —thus successfully evading the Indians sent after him. A little later, the Americans at Crown Point retired to Ticonderoga where, on October 27, General Carleton exchanged a few shots with them and then withdrew to Crown Point for a brief halt before returning to winter quarters in Canada. The abandonment of the projected invasion was undoubtedly due to the very vigorous and effective resistance offered by Arnold.

The gallant action of the *Royal Savage* and the knowledge that she was sunk off Valcour Island has proved a lure to historical relic hunters, especially in the last 25 years. Residents of the neighboring region have in their homes mementos of the craft that were salvaged while the wreck was fairly accessible. Subsequently, the winds, the weather, and the surge of ice floes wore away or carried away so much of the hulk as lay above or close to the surface of the lake and shoved what was left into deeper water—the framework coming to rest on a sloping ledge where the timbers blended with the water bed and could be seen only under very favorable conditions of calm water and light. Eventually, uncertainty prevailed just where the wreck lay.

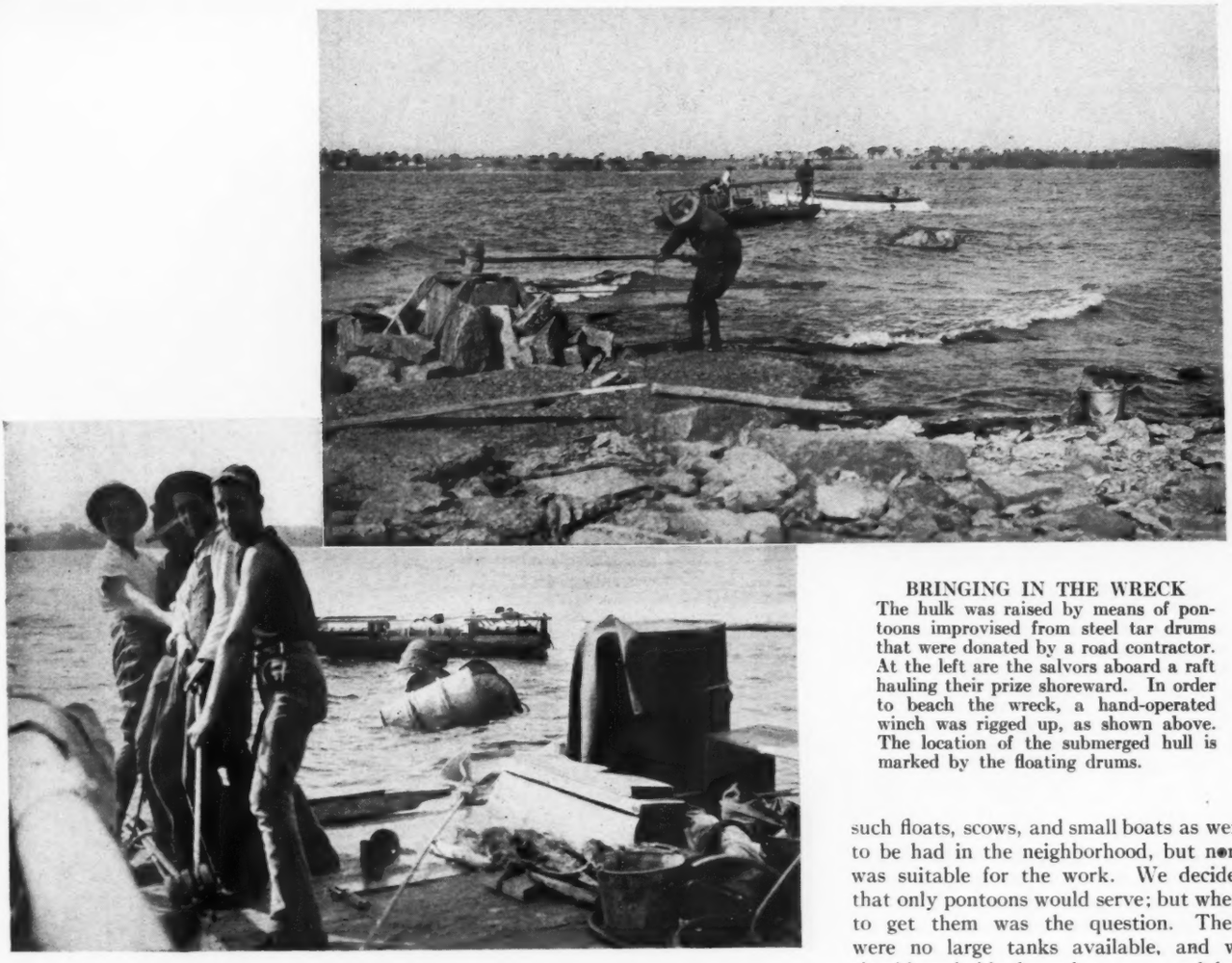
The record of the *Royal Savage* made a strong appeal to L. F. Hagglund when at Plattsburg in 1917 training for service overseas. Her historic importance was kept alive in the vicinity by the repeated use of her name in connection with local landmarks; and Captain Hagglund decided to spot the hulk and, if possible, to recover it for preservation in some appropriate setting. It was not until 1932 that he could take any steps to that end because of the more pressing demands made upon him as manager of the Under-Water Metal Cutting Corporation of New York. That summer, after reaching Plattsburg, he made frequent but futile use of local boatmen to help him locate the wreck. A resident geologist did offer him worthwhile guidance that at least narrowed the area to be searched. In the end, Captain Hagglund brought into service diving gear that he had taken with him from New York City and that enabled him to examine closely the bed of the lake. Let him tell his own story.

"After going to the bottom, I made a succession of exploratory circles hoping to come upon the wreck, but I did not do so. Finally, on a calm day, with the sun directly overhead, I rowed out to a point where the wreck was said to lie and let my boat drift while I shaded my eyes and peered down into the water. To my delight I suddenly discerned the fore part of her framing about 16 feet below the surface and approximately 150 feet offshore. Later, in a diving suit, I found that the *Royal Savage* rested upon a slanting ledge with her afterbody about 25 feet underwater— a considerable part of her stern being embedded in 4 feet of mud. So far so good; but I could not spare any more time that season to make sure that I had found the historic craft. The best I could do was to take cross bearings so that it would be possible for me to return to the true position.

"The news gradually spread in the neighborhood that the whereabouts of the wreck had been discovered; and the next summer a number of enterprising college boys on vacation got the relic-hunter's fever and set about satisfying it. Most of those youngsters were at home on the water, and some of them were good enough divers to take a line down and tie it to a projecting rib. That done, the other fellows at the surface would jerk away in unison on the rope until a piece of timber broke loose. Learning of their activities, I realized that no time should be lost in

AN INSPECTION TRIP

Ralph E. Chapman, president until his recent death of the Philadelphia Derrick & Salvage Corporation, became interested in the salvage of the sunken craft and lent his assistance. He is shown here about to descend to inspect the hull. His son is acting as his tender.



BRINGING IN THE WRECK
The hulk was raised by means of pontoons improvised from steel tar drums that were donated by a road contractor. At the left are the salvors aboard a raft hauling their prize shoreward. In order to beach the wreck, a hand-operated winch was rigged up, as shown above. The location of the submerged hull is marked by the floating drums.

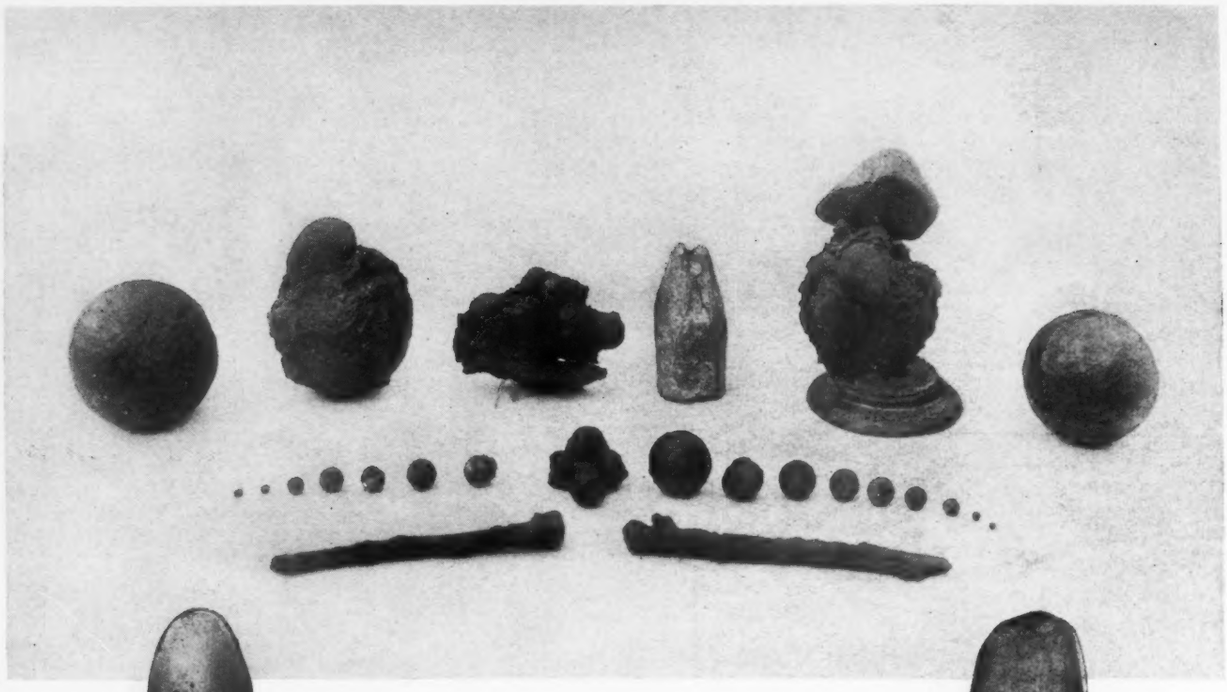
salvaging what remained of the *Royal Savage*.

"Last summer I motored to Lake Champlain and established a camp and working base on Valcour Island—again carrying with me a diving dress, ample air hose, and an air compressor. I hired a boat and some local labor. Our first aim was to explore the hulk where it lay; and I decided that a thorough search of the mud-covered section would be likeliest to yield parts of the vessel's original fittings and possibly personal articles of the men on her in 1776. The quest had all the thrills of a treasure hunt, and brought abundant reward.

"Among our finds were round shot, grapeshot, musket balls, and even buckshot. The many pieces of a shattered iron pot picked up in different parts of the wreck, and even beyond it, are mute testimony of what took place when the fire reached the magazine. Musket flints of both English and American origin reveal that Continental and British troops were successively aboard her. American military buttons, with regimental or batallion numerals, indicate the diversified sources from which Arnold's men were drawn. But probably the most valuable finds were several somewhat crude and heavy pewter spoons that are impressed with the initials, and in some instances with the identifying symbols, of well-known workers in that metal at that period. Nearly all the spoons carry the crudely scratched initials of the men to whom they were issued, and one is etched with the year 1776. Embedded in a shapeless mass of iron oxide is a square-cut topaz; and a cut-steel shoe buckle and some ornamented buttons tell the story that there were among the fighting men those that had a taste for adornment. Just as a prospector pans for gold, so we washed and sifted all the mud lying within the framing of the wreck's afterbody, and we even pursued this course near to but outside the craft.

"Our next problem was to refloat the vessel and to haul it on to the beach. It was then that I called upon a friend in the marine-salvage field, the late Ralph E. Chapman, to join forces with me, and two days later he and his son Edward reached our camp. Both were enthusiastic at the prospect of playing parts in getting the wreck up and ashore. None of the usual salvage equipment was at hand, and we were frankly puzzled about how to proceed. We weighed the possible uses of such floats, scows, and small boats as were to be had in the neighborhood, but none was suitable for the work. We decided that only pontoons would serve; but where to get them was the question. There were no large tanks available, and we should probably have been stumped had not a resident, who had shown understanding interest in our efforts, told me that he had some empty tar drums remaining from a road job in the vicinity. Those containers were of steel, and were about 28 inches in diameter and 4 feet long. Each had a capacity of 55 gallons, and was able to exert a lift of approximately 300 pounds when empty and submerged. Tied together in a string, we towed 20-odd of them from a point about a mile up the nearby Little Ausable River and assembled them on the beach of Valcour Island. The bunghole of each drum could be sealed with a screw plug. When a sufficient number was ready, they were floated out and over the wreck, allowed to fill with water, and guided down so that each could be set parallel with the keel and resting across two of the craft's ribs. Thus, a succession of tanks, each with its bunghole on the underside, was lashed on each side of the center line or keel.

"The next operations consisted of attaching air hose to and of admitting compressed air into the drums, one after the other. Wearing my diving helmet, I would go down, insert a line into an open bunghole, and return to the surface to connect that line to the air pump. This



RELICS FROM THE VESSEL

Both from the hull and from the mud that encased it, many interesting articles were recovered. Here are shown some of the finds, including cannon balls, grapeshot, musket balls, sounding lead, and three pewter spoons which were evidently issued to the men aboard the schooner.

was necessary because the compressor could not simultaneously furnish air to my diving suit and a tank. When the contained water had been expelled by the air, then the bung was screwed into place. The two bow drums were the first to be made buoyant; and then followed the same procedure, sternward, with the others. Finally, when 22 had been blown free of water and plugged, the *Royal Savage* broke away from the lake bed and rose to the surface. As soon as she was afloat, we towed her shoreward until she grounded, and then with the aid of an improvised winch and tackle, we drew her up on the beach. Thereafter we were able to examine deliberately the hulk of Arnold's erstwhile most formidable vessel.

"In the days of her prime the *Royal Savage* had a beam of 15 feet, a length of 50 feet, and carried a complement of 50 men. Her main battery consisted of twelve 4- and 6-pounders, and she was armed, besides, with twelve swivels. She was no match for any of the large square-rigged ships that General Carleton had had fabricated for him in England; but, nevertheless, she was in the forefront of the battle on that fateful October 11, 1776. The British stripped her before setting her afire; and some of the few metal relics indicate how the flames swept her.

"With the wreck out of water, and desirous of preserving it, it was evident that it would have to be either continually guarded to protect it from relic hunters or removed to some place of safekeeping. With my vacation drawing to a close, I dismantled it and, after marking each piece to facilitate subsequent reassembling, put the dismembered timbers into a box car to ship them away for storage following treatment with a preservative. That night before the car started on its journey southward I slept in my automobile which was parked close alongside the track.

"The wreck is a reminder not only of an extremely crucial period in our national career but it turns attention to the service of an unusually capable and courageous man who gave without stint of his best before his patriotism failed because of recognition denied him through the jealousy and intrigue of smaller minds. When at his best, Benedict Arnold trod the deck of the *Royal Savage*."

BUILDERS INVADE PARK

On the Philadelphia side, the subway will pass beneath Franklin Square. Excavating there is being done by the open-cut method, and little foundation underpinning is involved.

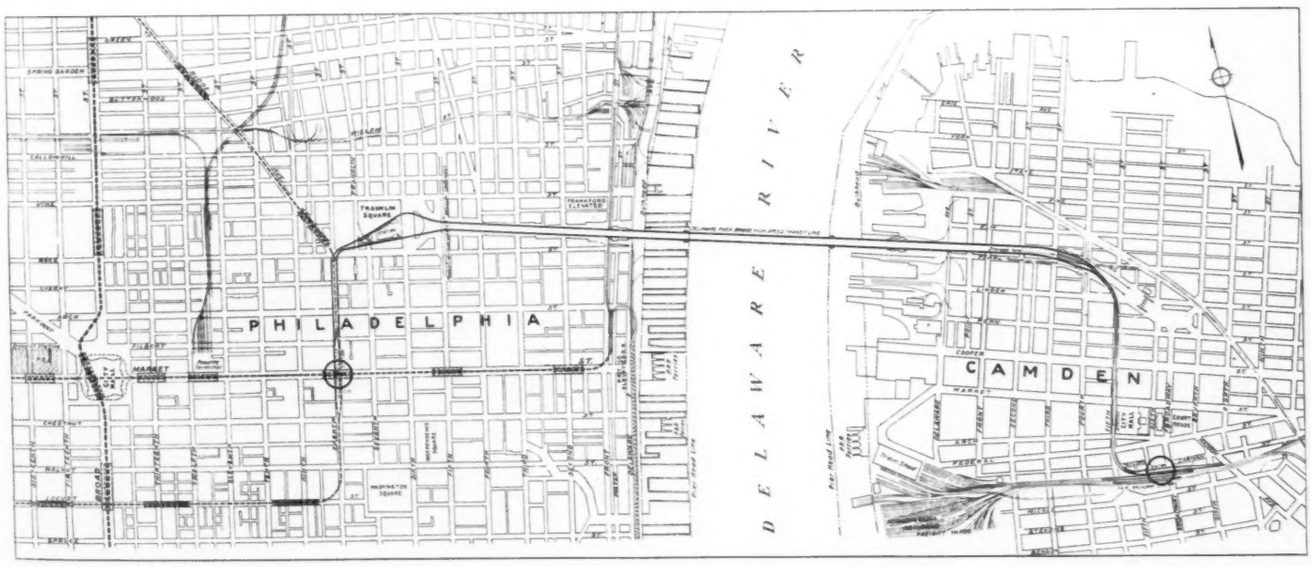
The Philadelphia-Camden High-Speed Railway

C. C. HARRINGTON

NOT so many years ago, the Delaware River at the present Philadelphia site, could be crossed only by Indian canoes or log rafts. After the white man erected a town on each shore, he built cumbersome though efficient ferryboats to carry him and his wares from one to the other. In 1926 a gigantic structure of steel and concrete linked the two cities, allowing pedestrians and motor traffic to cross the stream 135 feet above water level.

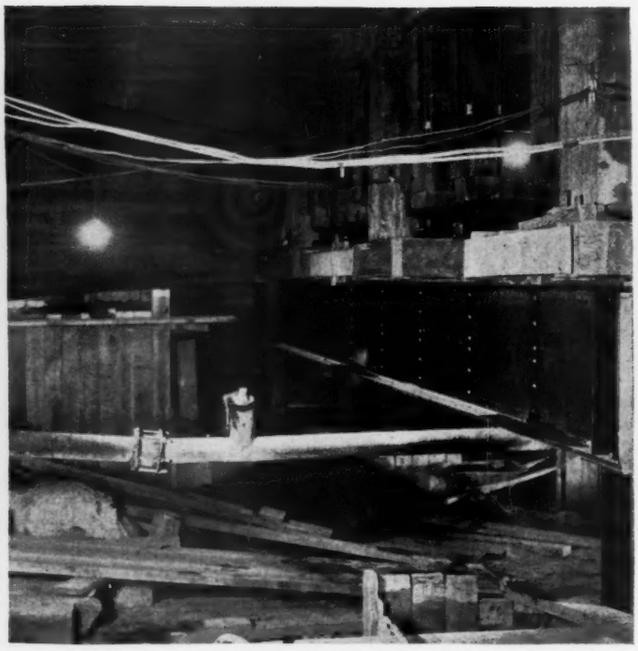
When the Delaware River Bridge was built, provision was made for the future installation of high-speed and trolley systems. At present, the high-speed system is being constructed. When this is completed, Camden and Philadelphia will be connected by a fast and convenient electric service. The work is being done by the states of Pennsylvania and New Jersey through the medium of the Delaware River Joint Commission which operates the bridge. The total cost of the electrification is estimated at approximately $12,000,000. A grant of $1,900,000 has been given by the PWA, which has also purchased a $400,000 block of a $10,000,000 bond issue. A considerable quantity of these bonds is being sold in the open market.

In view of the thousands of South Jersey residents who commute daily to Philadelphia, and the large number of Pennsylvanians who have occasion to come to New Jersey, an efficient means of transportation is a vital need. The present bus service, while satisfactory as such, cannot, because of traffic considera-



ROUTE OF RAPID TRANSIT

Sometime next year, rapid transit will be available to the 22,500,000 passengers who each year cross the great Delaware River Bridge between Philadelphia and Camden. The map shows the course of the line, with its terminals on either side marked by circles. The system is being built at an expenditure estimated at $12,000,000.



DETAILS OF CONSTRUCTION

Details of the method used by the Triest Construction Company for aligning steel sheet piling are shown above, at the left. Timber frames hung from H-columns and jacked into position can be set quickly and removed easily for re-use elsewhere. Where the tracks turn from the Camden bridge approach into Fifth Street, modifications of the bridge-approach foundations are necessary. This involves placing new footings and transferring the load to them. In the picture on the right is seen a girder supported by new foundations, with jacks relieving the strain on the original concrete columns. The latter are cut off just above the girder level with "Jackhamers" preparatory to interposing steel needles.

tions, compare with a high-speed-train bridge system with subway approaches located at convenient points underneath each city.

Estimates, based on actual traffic counts, indicate that 22,500,000 passengers will use this line annually. This corresponds to an average week-day total of 66,000. The maximum movement in one direction will be about 6,600 persons per hour. The capacity of the line one way will be limited by the facilities of the Philadelphia Eighth Street Terminal, which must be shared with the existing Eighth Street Subway, and will be about 17,000 passengers per hour. The running time between terminals will be approximately nine minutes.

From the Eighth Street Station, the line will continue beneath Eighth Street and swing under Franklin Park and thence on to the bridge approaches. In Camden the track will proceed below Fifth Street to a station and a bus terminal at the City Hall, in the center of the town, where transportation will be available to most of the communities in southern New Jersey. A system of crossovers is to be provided, and this will make it possible for passengers to utilize both sides of each station platform and will enable trains to run from the eastbound on to the westbound tracks. The measured distance from one terminal to the other will be 2.68 miles.

The major construction work involved in the undertaking consists of the subway approaches on either side of the river. Digging a subway under the streets of an active city is much like trying to remove a pillow from beneath a sleeping baby. The tall buildings on either side give immediate and unmistakable indication of any tampering with their foundations; and traffic, which has scant respect for surveyors or riggers, insists upon continuing unmolested.

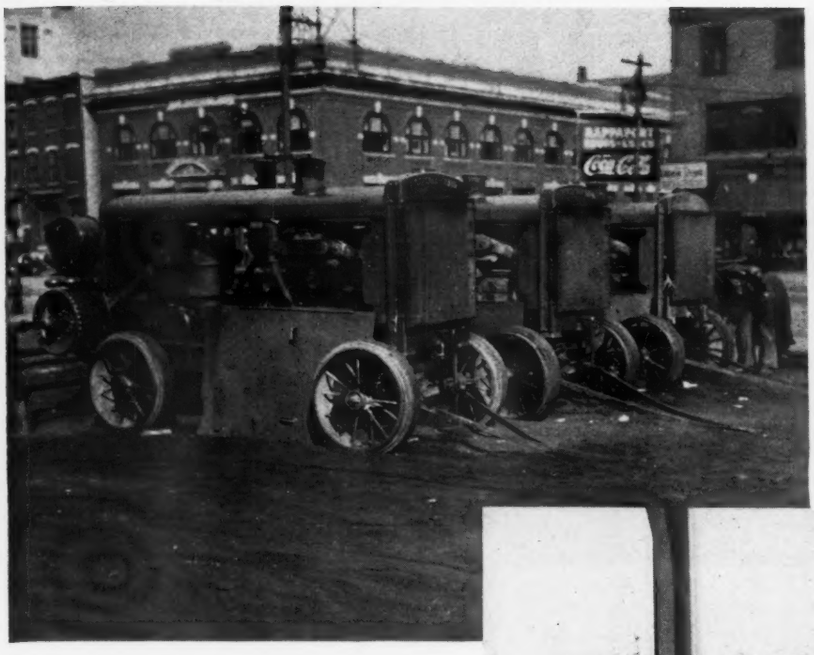
In Camden, where the subway is underway, the buildings on either side of the street have presented considerable difficulty. The foundation of each structure has had to be reinforced, and the entrances and approaches to all of them must be kept open.

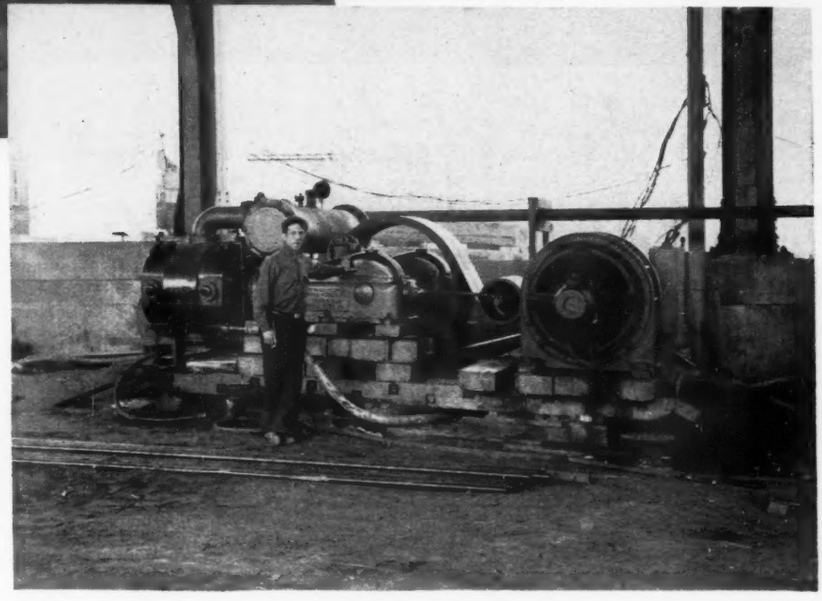
The subway work there is being carried on by two contractors. The Marcus Contracting Company, of New York, has a 2,050-foot, 2-track underground section and about 800 feet of open section. This contract also includes the modifying of the existing bridge-approach foundations and the construction of a street underpass. It amounts, all told, to $1,374,000. The second contract was awarded to the Triest Construction Company, of Camden, on a bid of $957,694 and involves 1,335 feet of subway construction, much of it along the side of a 20-foot railroad embankment.

The contractors are using 7,200 tons of steel sheet piling to line both sides of the excavation area. These are being driven with compressed air; and to supply the air required to operate the hammers and to do other essential work the Marcus Contracting Company has set up a battery of portables while the Triest Construction Company erected a structure housing three electrically driven units. Six-inch feeder lines distribute the air to all parts of the job.

On Fifth Street the contractors are excavating under cover. First they set the sheet piling, and then, after breaking up the street surface and digging deep enough to lay crossbeams, the whole area is covered with planks laid in small sections. By removing one section at a time and working through the opening with a clamshell bucket, it is possible for the crews to excavate below while trucks and crawler cranes move about on the street level. The total amount of excavated material on the Camden side will be about 170,000 cubic yards.

Considerable interest has been aroused by the method used by the Triest Construction Company for aligning steel sheet piling. Rows of H-columns are first driven about 5 feet apart with a 3¼-ton air hammer. Next, a trench is dug between those rows, planks serving as sheeting. In this trench are suspended 12x12-inch frames, properly spaced to guide the piles. These frames are hung and jacked into position from the H-columns, and can be placed very quickly. Likewise, after the piles have been driven, they can be removed bodily and set up somewhere else. The whole procedure





COMPRESSORS

The various contractors concerned have ten compressors on the job to supply air for driving piles, operating rock drills, and for other purposes. At the left are three of the five portable units employed by the Marcus Contracting Company, while one of the three stationary machines used by the Triest Construction Company is shown below.

makes for exceptionally quick and easy aligning of the piling, and permits using the same aligners over and over again. A 3¼-ton hammer serves to drive the piling, and a 4¼-ton unit is employed on the heavy shoulder columns used for side bracing.

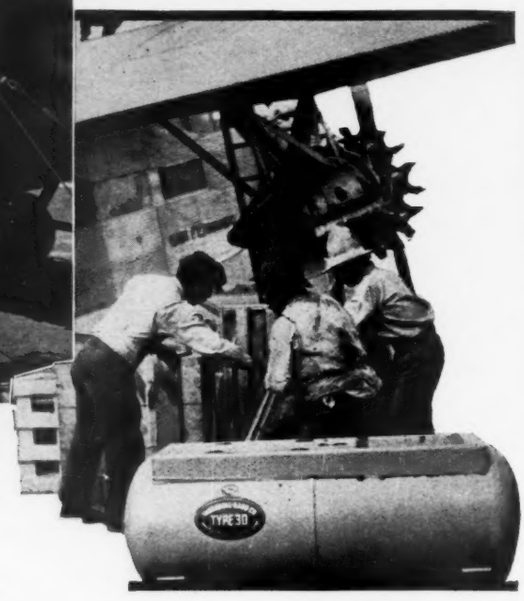
The subway terminates alongside a 20-foot railroad embankment, and there the contractor is driving 58-foot steel sheet piling. In order to handle such long piles from the ground level below the embankment, it has been necessary to put extensions on the crane booms and to lift the steel from the center with one end weighted down. The entire subway on the Camden side will require 11,200,000 pounds of structural steel and more than 44,000 cubic yards of concrete.

A change in the Camden bridge-approach foundations also is of interest. These have to be modified in part so as to enable the tracks to pass under the approach and to swing into Fifth Street. To do this, pits are dug on either side of the track lane, new foundation footings are poured, and on each of these a pair of columns is erected and connected overhead by two girders. These girders extend closely along both sides of the original concrete columns. After the weight of the approach structure is transferred to the girders by means of temporary jacks, the original columns are cut off just above the girder level with "Jackhamers." Three steel needles are then placed between the girders and the cut-off concrete columns. When the jacks are finally removed the columns are supported by the girders and the tracks can be laid beneath this new support and between the new footings. These operations, together with the construction of a large adjacent street underpass, represent most of the work being done by the Marcus Company. An electrically driven air compressor has been set up under the bridge approach and serves as a separate source of air supply for this particular phase of the subway operations.

The work on the Philadelphia side is being done by Builders, Incorporated, of the same city, who were awarded the contract on a bid of $998,394. There, much of the subway is under Franklin Park, necessitating little disturbance of nearby building foundations. Excavating is mostly open-cut work, using H-columns and plank sheeting. The length of this section, which connects the bridge with the existing Eighth Street line, will be 1,140 feet. Compressed air is distributed throughout the job from a temporary plant housing two electrically driven compressors. A 1,450-foot underpass is being constructed to carry Fifth Street beneath the tracks where they approach the bridge. This work, together with the subway, calls for 108,000 cubic yards of excavating, the pouring of 25,000 cubic yards of concrete, and the erection of nearly 3,000,000 pounds of structural steel. But little steel sheet piling has been used, and that on a short stretch where the westbound tracks drop below the level of the eastbound to pass under the existing tracks of the Philadelphia Eighth Street Subway. At this point 70 tons of piling was driven between the two track levels.

Two substations will furnish direct current to the traction equipment. One station will be located in each city, and will be provided with two 2,000-kw. mercury-arc rectifiers. Primary power for these machines will be supplied by the utility companies serving the respective cities. Final specifications for the rolling stock have not yet been completed. However, the cars probably will be similar to those operating on the present Philadelphia Subway systems, with the possible exception that much lighter metal will be used in their construction.

At the present rate of progress, it is expected that the high-speed system will be ready for service before the close of 1935.



LOADING SCENES

Heavy pieces were loaded through a hatch cut in the top of one plane and were handled by a stiff-leg derrick operated by a hand winch (left). Lighter pieces were put aboard a second plane (below) through the side door used by passengers.

Flying 740 Tons of Freight Over the Andes

THE airplane may prove to be the salvation of some of the remotely situated mines of the world that are handicapped by almost insurmountable transportation problems. This is particularly true of properties in the high, inaccessible Andes of Peru that have lain dormant for long periods because costs of freighting in equipment and supplies have been prohibitive. Several such mines are looking to the future with renewed interest following the successful flight of 740 tons of freight from Cuzco to the Ccochasayhuas gold mine 50 miles away and across a 15,000-foot mountain range.

In June, 1933, Pan American-Grace Airways, Inc., carried 55 tons of machinery from Cuzco to the mine head at Huanacopampa. These operations were described in our October, 1933, issue. They were so successful that, when a further enlargement of the plant was decided upon, the operating company, Explotadora Cotabambas, again turned to air transportation without question and commissioned the same aviation concern to do the work. Flights began on August 14, 1934, and were completed on October 31. During the intervening period, 421 round trips were made without mishap.

Loaded planes took off at an altitude of 10,900 feet from a runway 50 feet wide and 4,400 feet long at Cuzco. They landed at Huanacopampa on an improvised field at an elevation of 12,800 feet. In crossing the Andes they regularly rose to a height of 16,000 feet above sea level. Throughout the flights, which consumed an average of 35 minutes each way, pilots were in continual communication with the ground through 2-way radio systems. Ground stations were established at both ends, and were in charge of trained meteorological operators who were able to give pilots advance information as to the weather conditions that would be encountered in crossing the range. The aviation company's main office in Lima, Peru, was also kept informed by radio of the progress of the operations.

Between August 14 and September 24, one plane was engaged in the work. This was a Ford tri-motored model powered by three supercharged Wasp engines, two of 550 hp. and a third of 450 hp. All interior fittings were removed from the cabin, and a 9½x4-foot hatch was opened in the top of the fuselage. Rails were laid on the floor of the cabin, and over this track a small car was run by a cable winch to dispose the load as desired. The second plane was of the same type, but as it was intended for the moving of only small pieces, which could be loaded through the side door, extensive alterations of the cabin were not required.

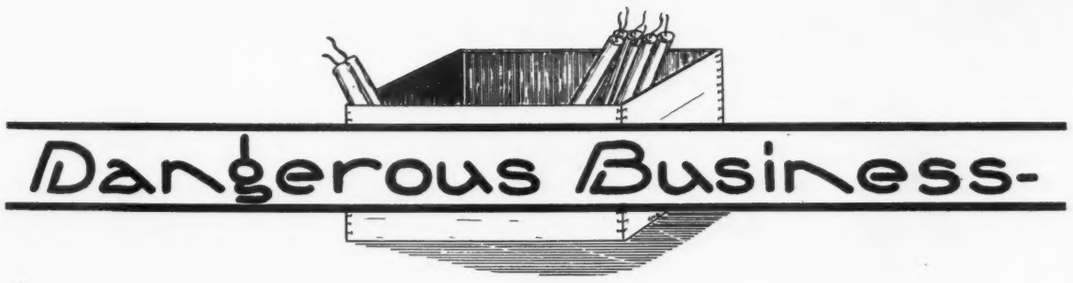
The freight comprised complete equipment for an amalgamation and cyanide mill of 150 tons daily capacity, additions to the hydro-electric plant to produce 750 more horsepower, and a large quantity of miscellaneous machinery and materials. The crushing, milling, and amalgamating plant was made by Fraser & Chalmers, the cyaniding equipment by Merrill Crowe, the electrical machinery by Westinghouse Electric & Manufacturing Company, and the compressors, drills, and other air-driven equipment by Ingersoll-Rand Company.

The heaviest pieces were transported first. These consisted of 26 mortars for the milling plant and ranged in weight from 4,254 to 4,362 pounds each. The best day's work by one plane was seven round trips, or a total of 25,500 pounds delivered. On several other days one plane made six round trips. The most favorable flying weather was encountered mornings: afternoon flights were frequently rendered difficult because of storms which were of such intensity on occasions as to cause suspension of activities.

By reason of the ruggedness of the country and the absence of graded roads, the only other way the freight could have been transported would have been by mule back or by human burden bearers. Mine officials have estimated that it would have required as many as 7,300 mules to move this aggregate weight of nearly 1,500,000 pounds, and that it would have taken on an average from three to four weeks to make a round trip.

The Indians living in the section covered by the flights were fascinated with the great mechanical birds that soared aloft with heavy loads. Some of them are said to have walked for eighteen days in order to see the planes. They staged a *fiesta* for one of the pilots and showered him with gifts.

As a result of this new turn in the transportation of mining machinery, manufacturers of such equipment are giving increased thought to the matter of designing it so that no piece will be too heavy for shipment by airplane.



Dangerous Business-

Wherein a Veteran Handler of Explosives Demonstrates That Dynamite Can Be Put to Other Uses Than Merely Blasting Rock

CHARLES DORIAN

IT WAS Pop Delaney's custom to tote a stick of dynamite in his coat pocket. By this token he was perhaps the first high-explosives bootlegger, because it was unlawful to transport them in that manner.

In the vernacular, Pop was an old-timer. He had hobnobbed with nature and hobnailed over a spacious expanse of rocky surface in his lifetime.

He was young and vigorous at the time of the Klondike rush. He had no flair at that time as a prospector. He had no name at all in that noble fraternity. He was as unleavened a sourdough as ever tumped a packsack. He emerged from the North with very little gold but plenty of experience.

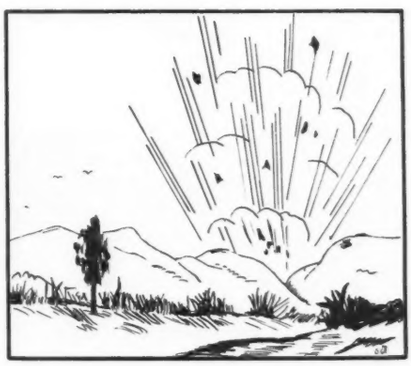
Pop was not a big man. There was nothing in his stature or his make-up to mark him a hero, nothing of the curious combination which makes personality. He was not even ugly or misshapen. In fact he was handsome in those Klondike days. His features were regular, his hair brown and curly, his eyes brown and dreamy, his teeth perfect and white. Not the sort at all you would suspect of being a dynamite bootlegger.

That dynamite obsession was acquired. It grew out of a plot to make a man of James J. Delaney. It was said that he was Lucy Gray's favorite suitor. Lucy thought Jimmy just a trifle effeminate. She wished him to develop a manly nature to replace the dilettante streak that was in him. She urged him to go out into the wide open spaces where man was a colossus who walked with giant strides and packed a stick of dynamite in each fist. That was James J. Delaney's cue, and it is further reported that Lucy never saw him again. Dynamite in each fist, was it? He'd show the world!

His provisions had petered out on that Klondike trek. There was a man named Billy Munn who would strike away from the beaten track to a place where he knew reposed a vein that promised to be the mother lode. There are thousands of such veins, which upon exploration turn out to be stepmother lodes. Anyhow, this Billy boy had a couple of mules and a surplus of provisions; but what he wanted in the worst way was some dynamite. Delaney did need some grub worse than he needed his dynamite, and the two got into partnership.

But James J. Delaney wanted to glimpse the Klondike, so he accepted a grubstake from Billy and mushed on. He remained long enough to wash up a few handfuls of nuggets, and started south again. In California he learned that all the gold prospectors were not in the North, and that all were not men. He assembled a goodly pack, including some dynamite, and started wandering again. His meanderings over a period of many years took him across many states and, eventually, into Ontario. Up to that time he had never done anything but stake claims, proving up his finds with a few shots of powder and then selling out for anything he could get. That "anything" was usually just enough to stake him to the next prospect.

He began to grow old disgracefully, getting gray at the temples, wrinkled around the eyes, and losing a front tooth which he never had replaced. He plodded along in his own weary way until he became known as Old Delaney and then as Pop Delaney, finally touching the pinnacle of fame under the name of Dynamite Pop!



It was as Dynamite Pop that he made his appearance in the Ontario Highlands with a carload of dynamite. He traveled by dog team to his claims, transporting the explosive by sled and caching it for distribution at a later date. He no longer cared about veins of gold-bearing quartz: he merely used his prospects as storing places for dynamite, and continued to carry a couple of sticks on his person and a few more in his packsack along with pick and moils. He sought to interest other prospectors in the stuff, and earned his name of Dynamite Pop by his spectacular method of demonstrating it. He carried percussion caps packed carefully, of course, in safety holders, but the fuse he coiled around his waist.

He appeared in the mining camp of Porcupine during its boom days. He stopped in the leading mining town and visited the storekeeper there at a late hour, so late, in fact, that he wondered why the place was still open. "How's tricks?" he asked, a grin spreading over his dirty gray stubbled cheeks, his eyes twinkling merrily, his cap askew.

"So, so," replied the storekeeper, noncommittally, appraising his visitor with an experienced eye.

"I'd thought you'd have remembered me," went on the visitor cheerily.

"Can't say as I do," admitted the storekeeper, eyeing the visitor suspiciously. "Where you from?"

"Just roamin' 'round," said the visitor, tantalizingly.

"Ever run across a hill-billy named 'Dynamite Pop' in your travels?" That was the usual preamble to establish the stranger's knowledge of the Highlands.

"Ever see any of this stuff before?" asked Pop, producing a stick of dynamite from his pocket and pointing to the brand mark on the paper.

"Say, this ain't no place to fool around with that stuff," the storekeeper said, alarmed, as Pop threw it up to the ceiling and caught it with his right hand. "I'm

"Don't take it out on the dogs," advised Pop, trotting over and recovering the sizzling missile. He picked it up and tossed it as far as he could in the direction of the road near the corner of the store.

aburnin' tamarack in that there stove."

"Don't need to worry about little local disturbances like that with this brand, Billy."

"Say, I know you," announced Billy Munn, the storekeeper. "You're the tenderfoot w'ot blew open the Munn claim for me up in the Caribou. Shake, pard!"

They shook hands, Pop playfully passing over the paw which held the dynamite and laughingly shifting it to his left.

"I remember the brand," went on Munn. "What you didn't know about prospectin' in them days would 'a filled a book as big as the family Bible. Mebbe y' learned somethin' since them days."

"Since I left you," grinned Pop, "I've been in every important gold camp from Alaska to California, and now I'm on my way into the uncharted mining fields of Ontario and Quebec, predicting as I go that the greatest gold find in the world will be made within a radius of a hundred miles from where we stand."

He took a jackknife from his pocket and, opening up his coat, cut off a piece of fuse. From another pocket he released a percussion cap from its safety box, neatly affixing it to the end of the fuse and crimping it between his teeth, and then inserted the cap end in the stick of soft gelatin.

"What in blazes you tryin' to do?" asked Munn, nervously, his thin putty-colored face turning a shade paler.

"Just demonstrating," said Pop. "I'm always ready for emergencies. I've been toting a case of this stuff since February, passing out the odd stick to prospectors along the way. I want to make you a present of this for old time's sake—just as a souvenir. You don't need to light the fuse right now, but keep it handy. The stuff I've got in the sleigh is frozen, and I thaw it out a stick at a time by keeping it close to my body. Here, take it, I've got another all thawed out in my clothes."

"Take it away! Are you crazy?" spluttered the storekeeper.

"No, quite sane, Billy. By the way, how much cash and bullion do you keep in the safe?"

Slowly, Billy Munn drew a wicked looking six-shooter from a shelf under the counter and leveled it at Pop. Pop just as coolly applied a lighted match to the end of the fuse.

"You wouldn't shoot, would you?" he grinned. "Let me see that baby."

Munn held out the gun and dived in forlorn retreat back of the store. Pop pinched out the lighted end of the fuse and called out: "Come on back, Billy. I'm not trying any holdup. I want to put you wise to something."

Slowly, stealthily Billy Munn crept back into his niche behind the counter.

"I'm surprised at you, Billy. Thought you knew me well enough to trust me. What's this you were asking me a little while ago about Dynamite Pop?"

"You sorta remind me of him, the way you handle that stuff, though I ain't never seen him. He handles dynamite careless like, and he talks like a bookish fella. Only Pop's a sort of hero. Last summer there was a terrible bush fire up this way, not right here, but fast headin' this way. This here Dynamite Pop had a lot o' powder planted up there he was tryin' to sell the gov'ment for road work and so on. Well, they soon found out they wanted that there powder in a hurry to blast out a firebreak, you know, blow down trees, and make a wide swath the fire can't jump. Well, sir, this Dynamite Pop went in there and planted powder for a mile, while sparks blew all around him. They say he got a big gov'ment contract to supply all kinds o' powder and dynamite after that."

"This is a good gun, Billy," observed Pop, examining the firearm minutely, apparently paying no attention to Munn's story about the heroism of his double. "But, honest now, suppose a desperate bandit came in here and covered you, would you shoot it out with him? That's why I asked you if you had much in the safe."

"There's upward o' two thousand," said Billy, mournfully. "I'd have to protect it."

"Got any family?"

"Yes, wife and two darters livin' down in T'ronto. I figger makin' a trip out before break-up wid what I got saved."

"Any help here?"

"Two men. One's down at Pete Goll's camp. Took down some medicine. Pete's been right sick. The other's out beddin' down the stock. He'll be in soon."

"Well, what I came in here for, Billy, was to sell you a carload of dynamite, or half a carload, as little or as much as you can use. It's risky keeping all that cash here. You ought to buy more stock, and the way I figure it out you're going to need a powerful lot of powder up here to supply the prospectors when the rush really sets in. I handle all kinds, from blasting powder to T.N.T. I'll sell you the carload I've got cached over on my claims forty miles north of here and move it in as you require it. I'll be trading in the dogs for a couple of ponies in a few weeks, but I'd advise you to lay in as much as you can while the ground is frozen. You can make a cache here half a mile out. I've been educating prospectors how to cut short their assessment work by the judicious use of good powder. I could make the rounds supplying it to them in small quantities, but I'm getting old, and you're right here in the midst of the camp, the logical source of distribution. I want to sell in big lots, to establish selling depots all along this new gold route, and I'm giving you the chance to lay out the biggest territory. It's no cinch getting this stuff in here, one or two hundred miles from a railroad. I have to tote it in by dog team all winter. Then, in emergencies, the government grabs all it can get close to the scene of operations."

"Say, you sly son of a cayuse, you're Dynamite Pop. Well, I might 'a knowd it. Do you know you throwd a real scare into me when you fust come in. It wouldn't be hard to hold up this joint, would it? I better, as you say, tie up some o' that money in powder. That wouldn't be easy to move, and, dang it all, bandits don't want to steal it. I'll take that carload."

"Now you're talking, Billy. I wouldn't worry much about bandits, if I were you."

"You wouldn't, eh? Look at that there poster on the wall behind yuh. When you fust come inside that door you looked jest like one o' them, I was figgerin' on stallin' till my two buddies come in. I wasn't none too sure you was that tenderfoot, either."

Pop turned and read about two desperadoes wanted for two major robberies and the murder of a prospector in the Yukon. There were the front and profile pictures of two hard-boiled *hombres*, unshaven and unkempt, a detailed description of them, the list of their crimes, the record of their escape from prison, and the offer of a large reward for their detention.

"Those babies hide in the cities," observed Pop, "would never mush up into this cold region."

The hired man walked in at that moment. Billy introduced him as Happy Harju, a grinning Finn. A few minutes later the other assistant, in the person of Bud Walker, came in. "How's Pete?" asked Billy.

"Pete's comin' round all right. He'll be up by Sunday."

To Pop, Billy said, "Pete Goll's another Klondiker. Been a good pal. How'd you like to come down day after tomorrow, bein' Sunday, and see him?"

"Sure, I mean to," said Pop. "I'll stay with him till he gets around. I have my sleeping bag right with me, don't have to turn anybody out of his bunk. See my dogs as you came in?" he asked Bud.

"Passed them on the road down in the pine grove. They're quiet sleepin'. Musta had a long mush."

"They're tired, all right. So am I. I'll be going to keep them company."

Sounds of dogs barking reached their ears as he opened the door.

"Strange dogs," said Pop. "Another team's coming in. Better douse the lights if you don't want to be kept up all night. Good night, boys."

"Hey, Pop!" shouted Billy. "You ain't agoin' to leave this here souvenir inside air ye?"

"Throw it here. I'll bury it outside in the snow just across in the park. Watch me."

The dog team was approaching from the north along the same route used by Pop. He stood listening, saw the store lights go out, and trudged carelessly toward the pine grove where his own dogs were bedded down.

He made a fire and sat down beside it to smoke. He knew that his dogs were not sleeping now. They had their snouts down but their ears were cocked. They were as much interested in the approaching canines as Pop was in their driver.

"The moon's bright. They're doing their mushing all night anxious to get somewhere in a hurry. There they go, two of them. They're stopping at the store. Billy's a fool to open up every time a traveler comes. Think he was running a hotel."

Pop could see Billy's tall figure passing from the lamp, which he had just lighted, to the door. He saw the men enter and Billy edge toward the counter. At that moment his attention was diverted by the appearance of two men from the back part of the house, saw them take up positions behind trees just across from the store. Pop chuckled to himself. His lead dog clambered to his four feet and came over beside him, nuzzling in his lap.

"Can you beat that, Kiyi? I bet a mule, all the time I was in that store I was shadowed from the outside by Bud and his pal. That helps to keep up Billy's courage. He expects those bandits to pay him a visit. They take turns staying awake nights to watch for them. They're after that five thousand reward."

Pop could not see exactly what was happening within the store, but he did see the two men go up close to the counter and Billy's hands go up. Then he could see Billy going toward the rear of the store with his hands still aloft and the two men pressing close behind. He assumed that Billy would be compelled to open the safe for them and let them get away with the money while Bud and Finn waited outside ready to shoot them down.

"Lie quiet, Kiyi," he caressed his dog and stood up. He tramped hurriedly back in the direction of the store and called out to Bud. "Ssh! It's the two desperadoes," hissed Bud. "We're goin' to blow up the dogs so they can't get away." So saying, he lighted the fuse of the 'souvenir' and tossed it over amidst the panting dogs.

"Don't take it out on the dogs," advised Pop, trotting over quickly and recovering the sizzling missle. He picked it up and tossed it as far as he could throw it in the direction of the road near the corner of the store.

The bandits had finished trussing Billy to his bed and looting the safe, and were coming around the corner of the store at the very instant the blast went off. It was like running into the face of a blinding blizzard. The snow and puff of wind kicked up in that blast sent the bandits sprawling on their backs and sucked the breath out of them. The settlement was aroused by the explosion, and its dozen or so inhabitants issued to the scene of the crash.

The bad men tallied perfectly with the descriptions. Pop assisted in restoring them to consciousness and disarming them. When the doctor and sheriff arrived several days later they were all dolled up ready for trial.

"Well," said Pop to Billy Munn, "of the hundreds of ways to use explosives somebody's sure to think of another!"

"Yeah," responded Billy, "and sometimes they just toss it around without thinkin'. That there new store front's goin' to cost me a coupla hundred dollars."

"You wouldn't shoot, would you?" he grinned. "Let me see that baby."

Picturesque Rangoon

THOMAS CORMACK

PART OF THE HARBOR

Rangoon is the third largest port in the Indian Empire. Ships from the world over call there for cargoes, consisting chiefly of rice, timber, and petroleum from the Burman interior. The harbor has ample deep-water berthing spaces and is equipped with modern facilities. The city is on the Rangoon River and 21 miles from the sea.

RANGOON, the capital of Burma and headquarters of the local government, is situated on the left bank of the Hlaing or Rangoon River which flows into the sea 21 miles below the city. It was of comparatively little importance until the British conquest of Pegu, when it developed with phenomenal rapidity from hardly more than a village into an up-to-date community with a population of 400,415, according to the last census which was taken in 1931.

But even though its rise to importance is recent, it is really a place of extreme antiquity, its history dating back to the year 585 A. D. when the Shwe Dagon Pagoda was built, forming a nucleus around which a small town sprang up. Under the name of Rangoon, however, it dates from 1755 A. D. Then Alompra—the founder of the last dynasty of Burmese kings—captured the village from the Talaings, established peace, and laid out on the river bank a new community which he called Yangon, the end of strife. Since then, and before entering on its present period of prosperous growth, Rangoon passed through a stage of languishment and decay when its population sank from that of a busy trading port of 30,000 people in 1794 to a bare 8,000 in 1826, unsuitably housed in mat dwellings on swampy ground. After the first Burmese war the town revived again, and its inhabitants increased to between 25,000 and 30,000 when the British took possession, thenceforth expanding rapidly until, today, it stands fourth in India in point of population.

In its present form, Rangoon is of modern conception, having been planned or laid out by Colonel Fraser after the annexation of Pegu in 1852. During the intervening decades it has been improved and developed beyond all recognition so that now it is one of the notable cities of the Far East as well as a port of great importance—the natural wealth of Burma, particularly in rice, timber, and petroleum, attracting to it ships from all parts of the world. Because of its heterogeneous population it is made up of numerous separate communities the residents of which, however, intermingle in the streets and give them a picturesque appearance. Europeans, among whom the British naturally predominate, Anglo-Indians and Anglo-Burmans, Burmese, Indians, Chinese, Armenians, Jews, and Japanese, are all to be found in such numbers as to create the distinctly cosmopolitan character that is so marked a feature of the capital.

Lying on the north bank of the river, Rangoon stretches from Kemmendine in the west to Pazundaung in the east, covering in all, from its boundary in the south to the Victoria Lakes region six miles away to the north, an area of 40 square miles. The city proper is laid out in blocks, the main thoroughfares running parallel from east to west and being intersected at right angles by numbered streets extending north and south. Beyond this geometrically patterned central section, where most of the business is concentrated, Rangoon loses its rectangularity and seems to have developed organically rather than to have been built according to plan. Visitors are impressed by its modernity, its imposing public structures, its large office buildings, its fine shops, its beautiful parks, and its broad streets alive and loud with their well-regulated traffic of trams, motor buses, taxicabs, and private cars of every conceivable make. Of its principal public buildings, it will suffice here to mention only the most conspicuous—the Law Courts, the Secretariat, the General Hospital, the new Port Trust Offices, the National Bank and Irrawaddy Flotilla Company's buildings, the Gymkhana Club, and the Anglican and Roman-catholic cathedrals. In beauty of design, size, and solidity of structure, all are worthy to rank with similar edifices in any European capital.

Striking an exotic note amidst all this western architecture, and rising above the whole city on an eminence near its northern boundary, stands the world-famous Shwe

Dagon Pagoda of which Rangoon is justly proud. This magnificent temple dominates not only the city but also the surrounding country within a radius of many miles. It is loftier than St. Paul's Cathedral in London, and is covered with plates of pure gold from base to summit. Its entrance is guarded by gigantic stone leogryphs, and on the spacious marble platform around the bottom are many smaller pagodas, shrines, and resting places. Pilgrims from the remotest corners of the province come to worship there, and sight-seers are attracted to it from distant lands. Tradition has it that, among other sacred relics, this shrine is built over eight hairs from Gautama, the founder of Buddhism.

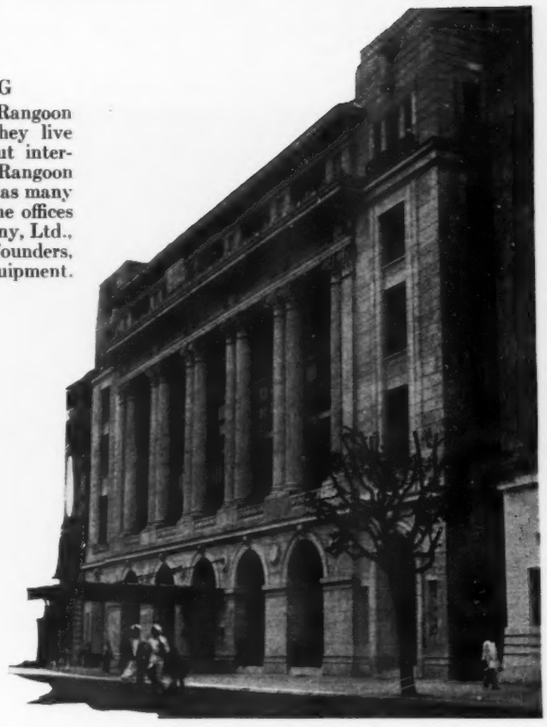
In Dalhousie Park and the Royal Lakes, Rangoon possesses pleasure grounds that are not surpassed in the Far East. They embrace 200 acres of thickly wooded land with winding paths and drives, sequestered glades, and a body of water 150 acres in extent. The latter is characterized by a picturesquely irregular shore line, with the Rangoon Boat Club, a sumptuous new building with a spacious balcony, on the south bank.

The old cantonment with its barracks and parade ground and officers' residences, once situated within the municipal limits near the northern part of the town, had to be abandoned for new military quarters owing to the city's need for expansion. The latter is located twelve miles outside of Rangoon at Mingaladon where, in an incredibly short time, a well-laid out town with electrically lighted roads and massive concrete barracks, residences, and offices has come into being.

Within close proximity of this cantonment, about a mile distant, is the aerodrome, a thoroughly modern flying field complete with hangar, administrative buildings, fueling station, aircraft direction-finding wireless station, etc. Lying as it does on the direct air route between Europe and the East, Rangoon is fast becoming an important center of aerial navigation. At present it is the port of entry into India for west-bound commercial planes, and is served by three trunk air lines operated by British, Dutch, and French companies. These give a weekly service east and west of Rangoon and are supplemented by a weekly local service that is maintained between Rangoon and Calcutta. In view of its strategic position, Burma's capital can therefore reasonably expect a vast increase in airplane traffic in the near future.

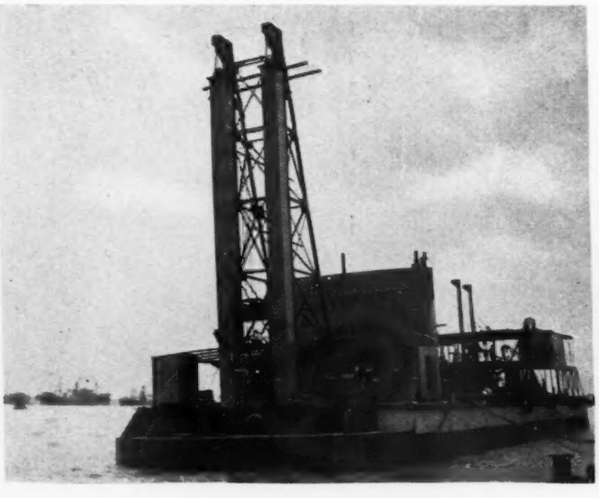
In conformity with what would appear to be a deliberate plan to keep abreast of the times in every way, as well as to provide a place of amusement for visitors and residents, the city has built a race course at Kyaikasan. It is within easy reach of the heart of the town by trams and motor buses that run at frequent intervals. No expense has been spared in its construction, with the result that it compares favorably with the leading racetracks the world over and is claimed to be the best in the Far East.

The Harbor of Rangoon is a bustling one, and is the third largest in the Indian Empire, being exceeded only by Calcutta and Bombay. Through it passes all the oversea's trade of Burma that is valued at more than one crore or 10,000,000 rupees annually. It is well equipped to handle that trade, and is administered by a board of commissioners most of the members of which are nominated by the government. With its deep-water wharves, ample docking facilities, hydraulic cranes, commodious sheds and godowns or warehouses, its banks lined with rice mills, saw mills, and other industrial establishments, the port presents as busy and as colorful a scene as is to be witnessed in any of the large ports east or west of Suez.



AN OFFICE BUILDING

The 400,000-odd inhabitants of Rangoon are of many nationalities. They live mostly in separate quarters, but intermingle in the streets. Downtown Rangoon is modern in every respect and has many imposing buildings. Here are the offices of the Irrawaddy Flotilla Company, Ltd., important engineers, builders, founders, and agents for compressed-air equipment.



ANCIENT AND MODERN

In moving heavy loads, the elephant (left) is still an important source of power, but his sphere of activity is narrowing. At the center is a Burma Oil Company suction dredge which can handle 18,000 cubic feet of sand and gravel an hour. Located on the trunk air line between Europe and the East, Rangoon is an aviation point of consequence. Below is a machine of the Imperial Airways at the Mingaladon aerodrome. This is one of three lines that maintain airplane traffic east and west from Rangoon.

Motion Picture Features Underwater Tunneling

AN EXACT replica of a section of the Fulton Street tube, through which trains of the new city-operated subway run between New York and Brooklyn, constitutes the principal setting for a forthcoming motion picture, *Under Pressure*, a production of Fox Films. It was completely and realistically equipped with all the apparatus, machinery, and tools ordinarily employed on underwater excavations which are driven under air pressure. The plot of the story centers around the trials and exigencies which attend the lives of "sand hogs"; and it is reported that more than half the action takes place in the tunnel.

As the accompanying pictures reveal, regulation equipment was installed, and some of it was filmed at work. The assembly of this miscellaneous array of material for the set proved quite a task, for it involved securing it from scattered parts of the country. A string of ore cars and a service locomotive were purchased from the United Verde Copper Company of Jerome, Ariz., and shipped to Hollywood to take their place in the circular tube section. Compressed-air equipment, naturally, is prominently identified with the picture. Some of this was loaned by Ingersoll-Rand Company, while "Jackhamer" drills and a drill-steel sharpener, which were actually operated during the photographing of the sequences, were rented from a contractor in Los Angeles.

The tube section used was 425 feet long and 17 feet in diameter, and is said to have been the largest outdoor set constructed in Hollywood during 1934. It was designed and built under the direction of Jack Otterson of the studio's art department, and required several months for completion.

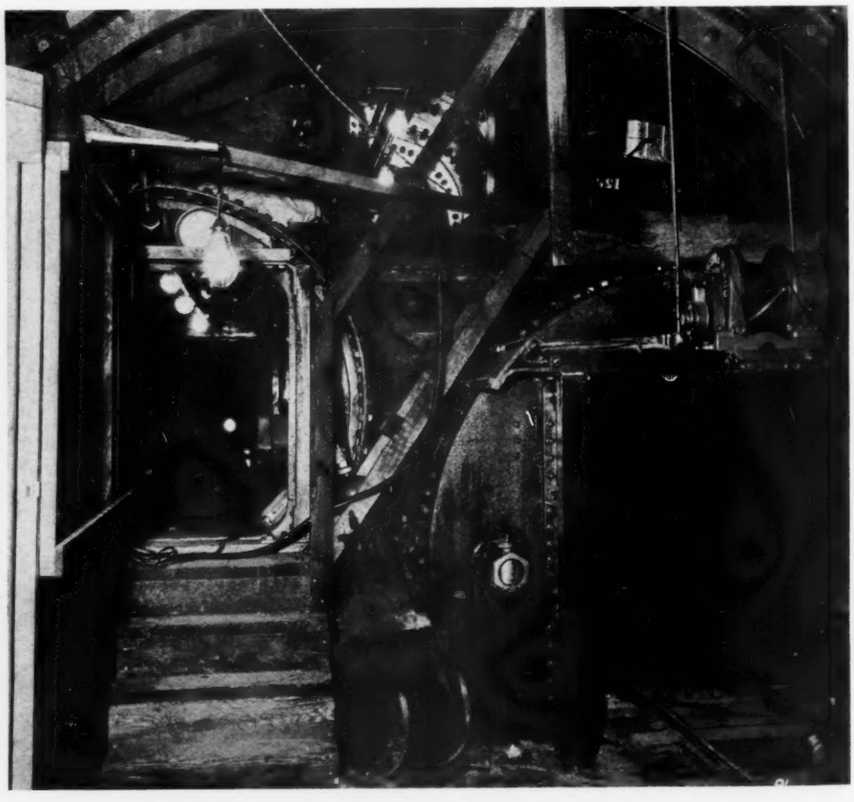
CELLULOID TUNNELING

Edmund Lowe, as a tunnel boss, during a dramatic moment in Hollywood's picturization of an underwater excavation job. Below is a view of the bulkhead in the realistic set representing a section of a New York subway bore. The man lock is at the left, the emergency lock overhead, and the material lock, with an air hoist just above it, is at the right.

A conventional shield for advancing the tunnel heading was incorporated in the set, and the usual air locks figure conspicuously in the story. The action depicts one of the actors as being overcome with the "bends," and a regulation medical recompression lock was provided to portray the treatment given him.

The film was adapted from a novel whose co-author, Borden Chase, worked on jobs similar to the one pictured before he turned to writing. He assisted in the preparation of the screen play and served in an advisory capacity during the assembling of the set. The Fox company also secured as technical assistant an engineer versed in subaqueous tunneling procedure in the New York area. Raoul Walsh, director of the picture, familiarized himself with conditions on an actual underwater contract by spending a week in the new Mid-Town Vehicular Tunnel which is now being driven under the Hudson River between New York and Weehawken, N. J. Under the tutelage of George B. Montgomery, superintendent for the contractor, Mason & Hanger Company, Inc., he was given first-hand knowledge of the job.

The featured players in *Under Pressure* are Edmund Lowe, Victor McLaglen, Charles Bickford, Marjorie Rambeau, and Grace Bradley. The picture, which was originally entitled *East River*, is scheduled for release on January 25.



GASES IN WARFARE

PROBABLY for the first time, accurate figures have been published regarding the use of gas during the World War. Writing in the *Military Engineer*, Maj. C. J. Brockman, of the Chemical Warfare Reserve, states that the total was 100,000 tons. The four principal belligerents—France, England, the United States, and Germany—together used 60,000,000 gas shells, or between 5 and 10 per cent of all the shells fired during the war. At the close of the conflict, an arsenal in this country had a daily capacity of 441,000 pounds of various kinds of gas and was filling as many as 80,000 shells a day.

It is a foregone conclusion that gas will be employed on a far greater scale during the next big war. Agreements among nations to outlaw its use will likely come to naught, for, as expressed by Major Brockman, "war is dangerous and, in the prosecution of war, no useful weapon can be overlooked or neglected, treaties to the contrary notwithstanding." He takes the stand that public condemnation of the use of gas is not entirely justified by reason of the fact that gas is actually more humane than high explosives.

Uninformed writers have distorted the truth concerning the lethal consequences of gas, he states. Assertions, such as are often made, that an entire city can be annihilated by one ton of mustard gas (really a liquid) dropped from an airplane rest upon the assumption that every inhabitant would inhale his quota of it, whereas a large proportion of them probably would not even know of its presence. By such reasoning, he points out, one might conclude that a single army service bullet, because it has sufficient force to penetrate 29 men standing one behind another, will actually kill that number of persons when it is fired.

Regardless of what the public may think, the fact remains that the army chemical corps of every large country is busily learning all it can about the most effective war gases and how best to employ them against an enemy. Possibly the winner of the next great conflict is even now being determined behind the barred doors that guard the chemical laboratories where these men work.

ADVANCES IN LIGHTING

TWO significant developments which directly affect all of us have recently transpired in the field of artificial illumination. One of these concerns better lamps for the home, the other a new type of globe which promises to revolutionize outdoor lighting.

Improved interior lamps came about as a result of the startling revelation that 40 per cent of American college students have defective eyes. The Illuminating Engineering Society, in seeking the reason for this condition, found that most dormitories, fraternity houses, and study halls were inadequately lighted. Further investigation disclosed that few homes provided proper light for children to study by. To remedy the situation, the society last spring formulated specifications for an approved study and reading lamp. Thirty-two manufacturers are now making this lamp, which bears a certification tag on which appears the society's monogram. These lamps came on the market late last summer. During September and October, 100,000 of them were sold, and it was confidently predicted that sales to the first of the year would total 500,000.

The new lamp is reputed to be 25 per cent more effective than older types of equivalent power consumption. It consists of a globe within an opal glass bowl, the whole surrounded by a shade having a wide flare at the bottom and mounted on a standard which is taller than that of the ordinary desk or table lamp. Direct light, without glare, is thrown upon the reading area through the opal glass, while indirect overhead illumination is also provided. The effect is adequate light and the elimination of shadows ordinarily cast about a room. The same principles have been applied to floor lamps of both the indirect and semi-indirect types. The new fixtures lend themselves to artistic designs, but not to such extreme creations as reproductions of oil lamps, candlesticks, lanterns, and other odd shapes which sacrifice light for decoration.

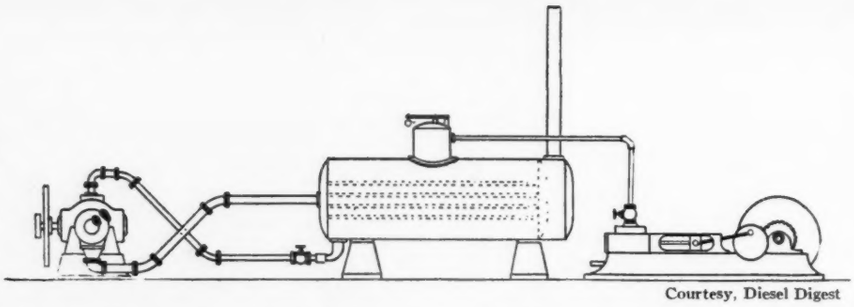
Illuminating experts have been equally busy on outdoor-lighting problems, and from the laboratories of General Electric Company has come the sodium-vapor lamp globe. It gives a soft, glare-free, yellow light; and is destined to be extensively employed, so it is believed, for the illumination of highways It will give two and one-half times as much light as an incandescent globe for the same amount of power. The bulbs, which are longer than conventional types, are filled with an inert gas such as neon, and then a pellet of sodium is introduced. Under heat, the sodium vaporizes. To guard against temperature drops which would decrease the lighting efficiency, the bulb is incased in an evacuated tube, the interwall space serving as an insulator. As ordinary glass is attacked by sodium vapor, the interior of the bulb is glazed with a borosilicate glass which resists the chemical action. Experiments indicate that daytime-automobile-driving conditions can be virtually duplicated by lighting highways with these new sodium lamps.

OUR COVER PICTURE

BY VIRTUE of the roadbuilding activities of the CCC, hundreds of American youths have become competent operators of rock drills during the past two years. Our cover illustration, made from a photograph by Orville L. Snider, shows a young "Jackhamer" man from one of the California camps at work in a picturesque setting.

MINE HOIST CONVERTED FROM STEAM TO AIR OPERATION

HOW to operate its steam hoist was the question that confronted the management of an Arizona gold mine when a diesel-engine-driven air compressor was substituted for its old steam-engine unit for reasons of economy. Mechanically, the hoist was in good condition; but how was it to be run with no steam available? There was a surplus of compressed air, and that was recruited to do the work.



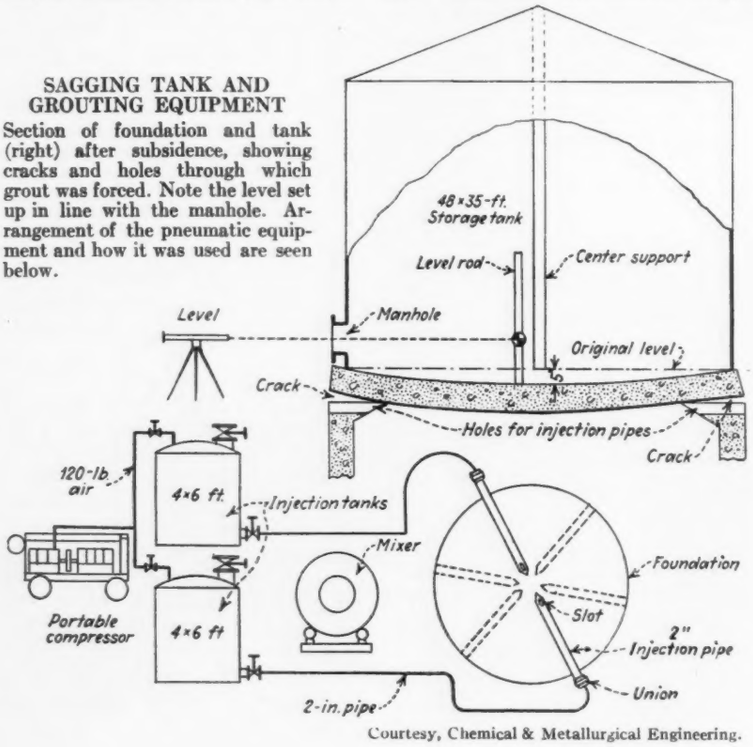
Courtesy, Diesel Digest

Alterations in the hoist and auxiliary equipment had to be made, of course, and considerable experimenting done before the service could be pronounced satisfactory. As first arranged, the air delivered to the hoist underwent a rapid drop in pressure because of heat loss, the mine being situated at a fairly high altitude and in a region where the winters are severe. In expanding in the hoist-engine cylinders, this precooled air absorbed heat from the surrounding materials, with the result that the lubricant congealed, the moisture froze, and clearances were reduced, all of which tended to cut down hoisting efficiency. More than that, the drop in pressure made it necessary to divert more of the compressor's output to the hoist, thus limiting the drilling operations.

After further study, the engineers again installed the old steam boiler, but in the capacity of a heat exchanger. For this purpose it was drained; the under plates, normally exposed to the heat of combustion, were insulated; and each end was provided with a gastight header. Modified in this way, the boiler was placed between the compressor and the hoist, the air being admitted into what had been the water space beneath the tubes. From there on it passed through the dome to the hoist. The needful heat was furnished by the exhaust gas from the diesel engine. This gas was piped into one header and out of the other by way of a stack. Heat was thus transferred from the gas to the air in sufficient measure to bring the air pressure back to normal. With this supplemental equipment, it is reported, "the compressed air provided entirely satisfactory hoist operation without undue demands on compressor capacity and with gratifying savings in operating outlay."

GROUT INJECTIONS REMEDY FOR SAGGING TANK AND FOUNDATION

THE method by which some of our state highway departments now raise sunken pavements was recently used to good effect in realigning a large storage tank that had been thrown out of plumb because of the subsidence of the underlying ground. The tank has a capacity of 500,000 gallons, is approximately 35 feet high and 48 feet in diameter, and half of the land on which it stands had been filled in to a depth of about 6 feet a year before its erection. This fact was taken into account in building the foundation, for the concrete pad or tank bottom was not poured until the site had been thoroughly puddled. However, when the tank was two-thirds full of water and ready for final testing, the lowest course of plates showed signs of deformation, and a horizontal crack appeared shortly afterwards in the upper part of the concrete wall on which the pad rests. This extended almost completely around the wall, and was widest at the point where the fill was deepest. Upon close inspection it was found that the roof of the structure sagged somewhat and that there also were several slight vertical cracks in the foundation wall. The tank was immediately drained, and upon further inspection by means of a level it was revealed that the center support for the roof was swinging clear of the bottom and that the latter had sunk about 5 inches.



SAGGING TANK AND GROUTING EQUIPMENT

Section of foundation and tank (right) after subsidence, showing cracks and holes through which grout was forced. Note the level set up in line with the manhole. Arrangement of the pneumatic equipment and how it was used are seen below.

Courtesy, Chemical & Metallurgical Engineering.

Upon deliberation, it was decided to try and raise the concrete base with its superimposed structure by the aforementioned method— that is, by drilling holes into the foundation wall and by forcing grout through them with compressed air. The equipment provided for the work consisted of a pneumatic drill, a concrete mixer, a portable compressor, two tanks approximately 6 feet high and 4 feet in diameter, and two 2-inch injection pipes. Each of these was about 20 feet long, with the free end closed, pointed, and slotted, and was connected to its charging tank by 2-inch piping. The mixture used was made up of 18 parts loam, 1 part portland cement, 1 part hydrated lime, and 25 per cent water, and was alternately forced out of the tanks with air at 120 pounds pressure.

It took nearly a full working day to inject sufficient grout to close the horizontal and vertical cracks in the foundation wall and to bring the tank bottom back to an even plane, thus correcting the deformation in the lowermost course of plates and in the roof of the structure. The following morning the level indicated that the concrete pad had been lifted to within ¼ inch of its original elevation. Since then no further settlement has occurred.

BRUSH VERSUS SPRAY PAINTING

COMPARATIVE tests conducted recently by an eastern railroad have, according to a report made public by the American Railway Engineering Association, conclusively demonstrated the superiority of the spray over the brush method in painting bridges or large surfaces. A deck plate-girder bridge was the object of the tests, and six different primers and paints were used. That everything might be equal, they were all applied to different spans on the north side of the structure where they would be subject to the same general conditions. Most of the time painting was in progress the weather was bad and a high wind prevailed that tended to blow away the spray issuing from the nozzle of the gun. The same type of equipment was employed throughout. In both cases one gallon of each of the several primers and paints was applied—each manufacturer's products being used in conjunction.

The figures given in the following tables are averages and cover all the materials tested. In the table showing the rating of the spray method as compared with the brush method, the figures are given in terms of increase and decrease. It will be noted that there is no question as to the savings effected by the use of the spray gun in applying the primers. With the paints, on the other hand, the results do not appear so favorable. While the time required to do the painting is from 82 to 91 per cent less, the total cost of coating 100 square feet, including labor and material, is 16 per cent higher. This, we are told, is accounted for by the fact that one gallon put on by brush covers a 42 per cent larger area than a gallon applied by spraying. Expressed in another way, 42 per cent less paint is used by the brush for each 100 square feet of surface, thus indicating a thinner film. Furthermore, the brushed coat is not so smooth nor so uniform because of the minute grooves made by the bristles. It is, therefore, highly probable that the sprayed film will prove to be more durable and, in the end, more economical.

	Primers		Paints	
	Spray	Brush	Spray	Brush
Weight per gallon, lbs.	14.5	14.5	8.8	8.8
Cost per gallon	$1.79	1.79	1.31	1.31
Area covered, sq. ft. per gal.	398.17	385.03	230.01	436.17
Man-hours per gal.	0.185	1.483	0.193	2.165
Man-hours per 100 sq. ft.	0.052	0.396	0.091	0.508
Cost per 100 sq. ft.	$0.453	0.722	0.724	0.625
Air pressure, lbs. per sq. in.	23	—	26	—
Atmospheric temperature, F.	26	37	23	33

SPRAY METHOD AS COMPARED WITH BRUSH METHOD

	Primers		Paints	
	Amount	Per cent	Amount	Per cent
Area covered, sq. ft. per gal.	131.4 inc.	34.2	206.16 dec.	42.2
Man-hours per gal.	1.298 dec.	87.6	1.972 dec.	91.4
Man-hours per 100 sq. ft.	0.344 dec.	86.9	0.417 dec.	82.3
Cost per 100 sq. ft.	$0.269 dec.	36.2	0.099 inc.	15.9

REMOTE-CONTROL COMPRESSORS

THE Ventura and Somis gas plants of the Industrial Fuel Supply Company, Los Angeles, Calif., each house compressors that can be operated by remote control from a central station located beyond the danger zone. From that distant point it is possible to stop all the compressors simultaneously and to free the plant of gas in 1½ minutes, so test has determined.

In the Ventura plant, which is the larger, there are four compressors: three low-pressure units and one high-pressure machine working under a pressure of from 250 to 300 pounds per square inch. In the intake lines of these compressors are interposed valves: a butterfly valve, operated by an air cylinder, in the case of each low-pressure intake, and an emergency stop valve of the swing-check type in the high-pressure intake. The latter is operated by a falling weight released by an air-actuated diaphragm. These several valves are connected by air lines with the central station, where a master valve is in control of their air supply and causes them all to be opened or closed in unison. There, too, is located the plant blow-down valve. This is installed in a large main that joins the discharge pipe just ahead of a nonreturn valve which prevents the gas from blowing back into the plant in the event of a broken main.

By this safety provision, the operator in the central station can, at a moment's notice, promptly stop the compressors and release all gas, the nonreturn valve in the discharge line closing with the cessation of flow. The equipment at Somis, which is a booster plant, is somewhat simpler.

NEW PUBLICATIONS

"MANY of the things you use in your daily life are effectively disguised under widely advertised trade names. 'What are their compositions? How are they made?' you are prone to ask yourself. Such things are mysteries to many; and even those who have had college educations must feel woefully ignorant in this respect.

"To cite but a few examples, ask yourself what you know regarding the compositions or methods of making adhesives, beverages, cements, colors, cosmetics, drugs, food products, glass, inks, insecticides, lacquers, leather, metals, oils, photographic materials, polishes, rubber goods, soaps, synthetic materials, textiles, water-proofings, and many other things too numerous to mention.

'Sugar and spice, and all things nice,
That's what little girls are made of.'

So goes the merry jingle. But knowing the composition of little girls, you may still be interested in what other things are made of."

From the preface to *Practical Everyday Chemistry*, a 305-page book of formulas and methods by H. Bennett, F.A.I.C., editor-in-chief of *The Chemical Formulary*. Published by The Chemical Publishing Company of New York, 1450 Broadway, New York, N. Y. Price, $2.00.

The Traylor Engineering & Manufacturing Company, Allentown, Pa., has produced an attractive general catalogue which describes and illustrates all its products. This firm makes equipment contributing to the mining and milling of ores, the crushing and preparation of rock products, the processing of numerous chemical materials, the manufacture of lime and portland cement, and the briquetting of ore, dust, and fuel. Copies of the 94-page booklet, Bulletin 5,000, are obtainable by addressing the company.

Ingersoll-Rand Company has issued a catalogue fully describing and illustrating its stationary-type 4-cycle, single-acting, solid-injection diesel engine built in sizes ranging from 175 to 1,500 bhp. It may be obtained from the company's main office, 11 Broadway, New York, N. Y., or any of its branches.

The Chicago Belting Company, 113-125 North Green Street, Chicago, Ill., is offering free engineering service to those plants that have hydraulic or pneumatic packing problems. To assist correspondents, it will, upon request, send condition analysis blanks which will serve as a guide in submitting problems for consideration.

We acknowledge receipt of an attractive 55-page booklet in which the Netherlands Harbour Works Company of Amsterdam, Holland, sets forth by means of pictures and brief descriptions its principal activities during the past 22 years. Sixteen large contracts, most of them in Far Eastern waters, are interestingly illustrated and summarized. One picture, in particular, strikingly calls attention to the wide geographical range of the firm's operations. It shows four large dredgers in tow and on their way from Holland to Shanghai, China, a voyage of 10,000 miles.

Industrial Notes

Spraying mold walls with soft soap will assure ingots with clean surfaces, says an open-hearth operator.

Visible air currents are of great assistance to investigators studying the movements of model airplanes, automobiles, trains, and other objects because their flow can be readily followed. They are produced by surrounding the model with a smoke screen applied under pressure.

Bad acoustics in the recently erected English cathedral at New Delhi, India, have been cured, so it is reported, by spraying the vaulted ceiling with a mixture of bitumen, shredded asbestos, and an adhesive compound to a thickness of 3 inches. The spongy or cellular coating thus formed acts as a sound absorber.

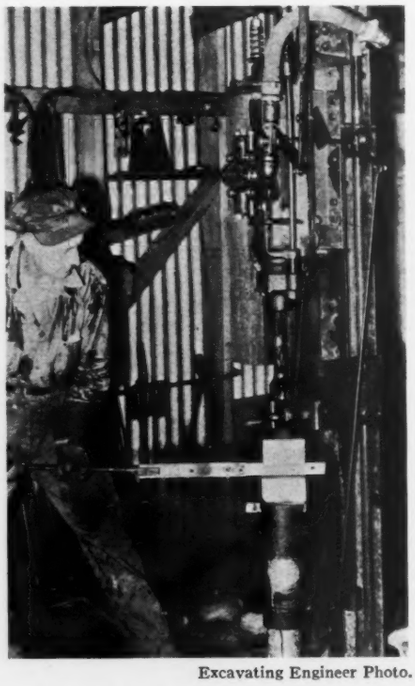
For sealing gaskets and threads in oil, steam, water, air, and other lines, the Ideal Commutator Dresser Company of Sycamore, Ill., has produced a compound that is said to assure a tight joint, to resist a temperature of 400°F., and to permit quick removal. The new material is marketed under the name of Ideal Perfect Seal.

The Tennessee Eastman Corporation makes a preservative, known as No-D-K, which is claimed to do two things well at the same time—namely, to protect ties, poles, etc., from insect attack and to prevent their decay. It is a highly concentrated creosoted oil extracted from hardwoods that is said to have an exceedingly high boiling point and to be insoluble in water—therefore, unaffected by either sun or rain. It can be applied by brushing, dipping, or spraying.

An emergency power plant on wheels is being turned out by the Harnischfeger Corporation, Milwaukee, Wis. It consists of a 50-kw. engine-driven generator set that supplies either direct current at 230 volts or 3-phase, 60-cycle alternating current, or both—the direct-current unit acting as an exciter for the alternating-current unit. It can be pulled around readily, and obviates changing over motors, brakes, and controls to meet individual requirements.

In reviewing its recent work in the metallurgical field, the General Electric Company announces a development of outstanding importance—a "heat-treated, electric-furnace, high-strength, ductile iron," or, in plain terms, an electrically melted, heat-treated cast iron. The metal is the product of steel scrap and coke, and is suitable for the making of castings. The charges, in this case, consist of transformer silicon-steel punchings and low-carbon steel plate. Carburization is effected by crushed coke, and the melting is done by means of a direct-arc, 3-phase electric furnace. The tensile properties of the iron range from 60,000 to 70,000 pounds per square inch, and the elongation from 4 to 7 per cent in 2 inches. For many purposes it is said to be a good substitute for standard malleable iron, and in other fields, because of its high strength, promises to be a better engineering material.

Until the discovery recently of a net that would be proof against the attack of marine microörganisms — creatures that attach themselves to it and finally bring about the destruction of the cotton or hemp fibers, fishermen along the Atlantic and Pacific coasts spent twenty cents out of every dollar earned for webbing. By simply substituting a few strands of fine copper wire for certain of the cotton yarns that enter into the making of seine twine, a problem of long standing has been solved —the natural salts present in the sea react with the copper to form complex metallic salts that keep those organisms away not only from the nets but also from the water immediately surrounding them.



Excavating Engineer Photo.

ANTIQUATED BUT STILL USEFUL

Though long since superseded by pneumatic rock drills of much greater efficiency, this old single-stroke Ingersoll-Sergeant drill is still sturdy enough structurally to give a good account of itself. We see it here in the guise of a 6-inch drop hammer with Charles Leslie, blacksmith at the Berdoo Camp on the Colorado River Aqueduct, who converted it to save labor. The improvised hammer is operated with compressed air, controlled by a foot lever, and is capable of delivering a blow of about one ton.

Glass thirteen times as resistant to breakage as that manufactured by the accepted methods has been developed in the laboratory, according to Arthur D. Little, Inc., industrial chemists. It is produced by reversing a practice of long standing—that is, instead of annealing the glass, cooling it slowly from the molten state to prevent the setting up of harmful stresses, it is chilled quickly from a temperature of approximately 1,500° F. either by a jet of air or by immersion in oil at about 400° F. The new material is not laminated nor reinforced in any way to give it such exceptional strength. It is said to break into small pieces with rounded and therefore less harmful edges, and to be clear enough for optical use.

Metal-covered plywood, known as Armorply, is a new product of the United States Plywood Company, New York, N. Y. The plywood itself is built up of a core of basswood with a thin sheet of Wisconsin birch on each side, while the metal, in sheet form, may consist variously of galvanized, stainless, or chrome steel, of copper, brass, Monel metal, etc. For special purposes the plywood may be combined with Celotex, Insulite, balsa wood, or cork. One or both sides of it may be faced—the bond being effected by a special elastic glue. The material is exceptionally light, sheets not exceeding 36 inches in width ranging in weight from 1.46 pounds for a square foot ½ inch thick and faced on one side to 3.35 pounds for a square foot ¼ inch thick and veneered on both sides. Armorply is now available in 80x190-inch panels.

A new material built up of alternate layers of bakelite and rubber firmly bonded together promises to have a wide field of application in the home and in industry in lessening noise and vibration. Synthane, as it is called, is said to have all the resilience of rubber and the strength and electrical and solvent-resisting properties of bakelite. It can be made up in sheets in which the number and the thickness of the individual layers may be varied to produce a material of any desired thickness and characteristics. Used in the making of kitchen table tops, for example, it might appeal to the housewife because of its pleasing color and because it will lessen the clatter of dishes. In the walls of buildings it will make rooms soundproof; and as a base for machinery it will absorb shock that is otherwise transmitted to floors, etc. These are but a few of the many claims made by the manufacturer for the "rubber sandwich," as he has dubbed it.